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THE FOUNDRY

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TRADE OUTLOOK.

There has been comparatively little change in the foundry trade outlook since the beginning of the year. Prices are somewhat better than they were during December but no general resumption of business seems to be at hand. Southern iron is quoted at $10.00 Birmingham for No. 2, though some furnaces have been willing to sell at $9.75 for immediate delivery. The Southern furnacemen are trying to organize a selling company in which they will all be stockholders and thus arrange to control the market. It is doubtful, however, if the movement can be carried through.

A number of furnaces were put in blast in the North in January and their capacity will increase the output at the rate of 2,500,000 to 3,000,000 tons per year. At present, about 60 per cent of the furnaces of the country are in blast. Northern furnaces have been able to readjust their cost sufficiently to enable them to compete with the Southern producers, but it is probable that the orders taken are close to the cost of production. Northern furnaces are holding their iron at $12.75 to $13.00 for No. 2 at the furnace. Some Central Western transactions are reported which netted the sellers $12.50 at furnace. In the East, Northern furnaces have been taking business from Southern sellers in the past 10 days, particularly at interior points to which Birmingham furnaces have high freights. The General Electric Co. has bought 7,000 tons of foundry iron for its Schenectady and Lynn plants. It is reported Northern furnaces took all of it and at low prices.

For some time there was talk of the Carnegie company and other steel producers entering the market with foundry iron. Most of the steel companies have not ore on hand of a suitable grade for the production of foundry iron and the Carnegie company has stated that it does not intend to enter this field.

There has been considerable business done in wire, and in bar iron for agricultural lines, which shows the buying power of the farmer resulting from the good crop conditions of the past season. It is to be hoped that in time these conditions will extend to other lines of manufacture and create a demand for foundry products. The railroads are not buying much new equipment and hence the malleable and other foundries depending on this class of work are slack. Some orders for cast iron pipe for municipal purposes are being let earlier than usual. Contracts for 5,000 tons were placed with a leading producer in one week through its Chicago office.

The heavy jobbing foundries and foundries engaged in the heavy machinery business h ve been buying some iron to cover orders now on their books, but in most cases report comparatively little work ahead. The number of men idle is probably about the same as in December, but it is hoped that as the season opens up trade will brighten along the entire line. It is stated that architects in the larger cities have a good volume of business on hand, and if the contracts for these new buildings are let, it will result in considerable work for all classes of iron and steel manufacturers.

It is certain that the outlook is better than it was early in December and conditions seem to be steadying themselves. If the necessary

adjustment as to costs can be made, especially in regard to labor, there is every reason to hope that the country will suffer no great period of depression, and that matters will adjust themselves so that there will be a fair volume of business throughout the country.

An interesting state of affairs exists in the case of charcoal iron production. These furnaces do most of their work in the winter when the wood can be handled on the snow. As a result the stocks of this class of iron increased 50 percent in December over those at the close of November, or from 60,000 to 90,000 tons.

Foundry Exhibit at St. Louis.

A movement is on foot among the foundrymen for an exhibit at St. Louis. This movement has not advanced far enough for us to state definitely what will be done, but it is certainly to be hoped that the foundrymen of the United States will see their way clear to support such an exhibit and make it a really attractive feature of the exhibition. The proposition in general is for the foundrymen of the country to raise money for a foundry building which will contain a foundry in operation. Also still exhibits of foundry supplies and equipment. The building will also serve as a headquarters for foundrymen visiting the exposition.

HYDRAULIC CYLINDER CASTINGS.

BY FRANK B. KLEINHANS.

Considerable difficulty is experienced in obtaining clean castings for the cylinders and plungers of hydraulic accumulators. One of these plungers for a 16-foot stroke machine is

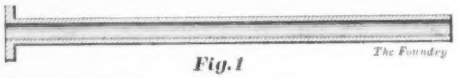


Fig. 1

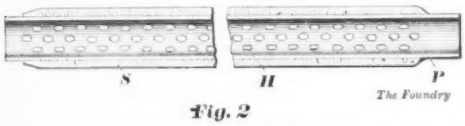


Fig. 2

shown in Fig. 1. The plunger shown has a cored hole extending the full length, so that the interior surface is acted upon by the accumulator pressure when the machine is in operation. This pipe is therefore subjected to a high bursting pressure, which requires a dense solid casting. At the same time the plunger supports the load on the accumulator, by acting as a column. It will be seen that nothing but the very best casting would be satisfactory for such a ram.

In the first place the design of the machine is such that we have one straight core extending all the way through. This core is made up as shown in Fig. 2. The core barrel used for the core is an extra strong hydraulic pipe, shown at P. This pipe should be several feet longer than the required core. Six rows of holes are drilled in the pipe about 5

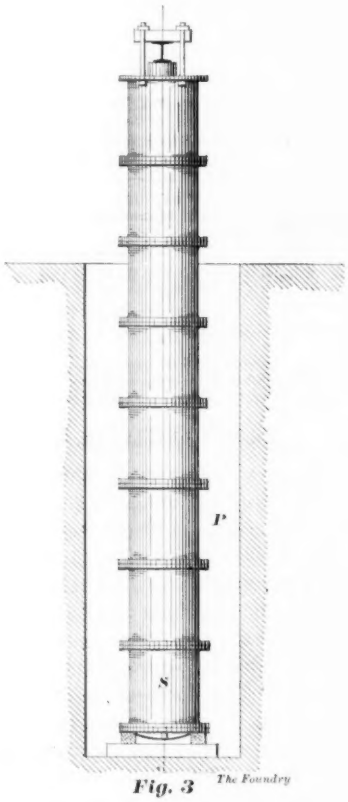


Fig. 3

or 6 inches apart. A pair of bearings are arranged to receive the core barrel, which is caused to revolve by means of handles fastened at one end; while the core barrel is being turned, straw rope S is wound on the outside. A plank is then arranged to serve as a sweep. Loom is then worked into the straw rope by hand and swept off to the required diameter by means of a sweep. The core is then raised from the bearings with a crane by placing a hook at each end of the pipe. It is next lowered on a car and pushed into the core oven to be dried.

To produce a sound casting it is necessary that the mold be made on end; this may be accomplished by the use of a pit, as shown at P, Fig. 3. The different sections, S, are placed one on top of the other and bolted together until the required length for the ram is obtained. The lower portion of the mold for the ram is shown in Fig. 4. A cone C is provided to fit the taper portion, which has been swept on the end of the core. The pattern is centered in the next section S and is rammed up with sand. The pattern is made 3 or 4 feet in length; after one section is rammed up the pattern is drawn up and used in the next section, and so on. The different sections are held together by bolts B, all of which should be drawn tight. A section of the top is shown in Fig. 5. After all of the sections have been rammed up they are put in the oven and dried. The sections are then lowered down one after another and are seated at the joint and then bolted together. The top section Fig 5 is put on after the core A has been lowered into place. An I beam is then placed over the top of the core and held down with clamp bolts, as shown at C. It must be remembered that the weight of the core is comparatively small in comparison with the weight of the iron which it replaces, and therefore we will have an upward thrust nearly equal to the weight of the iron replaced. Many expensive castings have been lost through improper clamping of the core or of the parts of the mold.

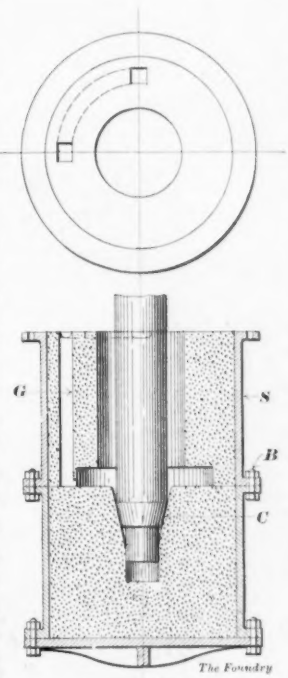


Fig. 4

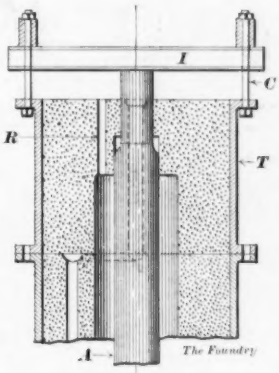


Fig. 5

The castings are made several inches longer than is necessary and the long end is always arranged on the top. The reason for this is, that although a riser R is provided there is also sure to be some dirt at the top when the casting is poured.

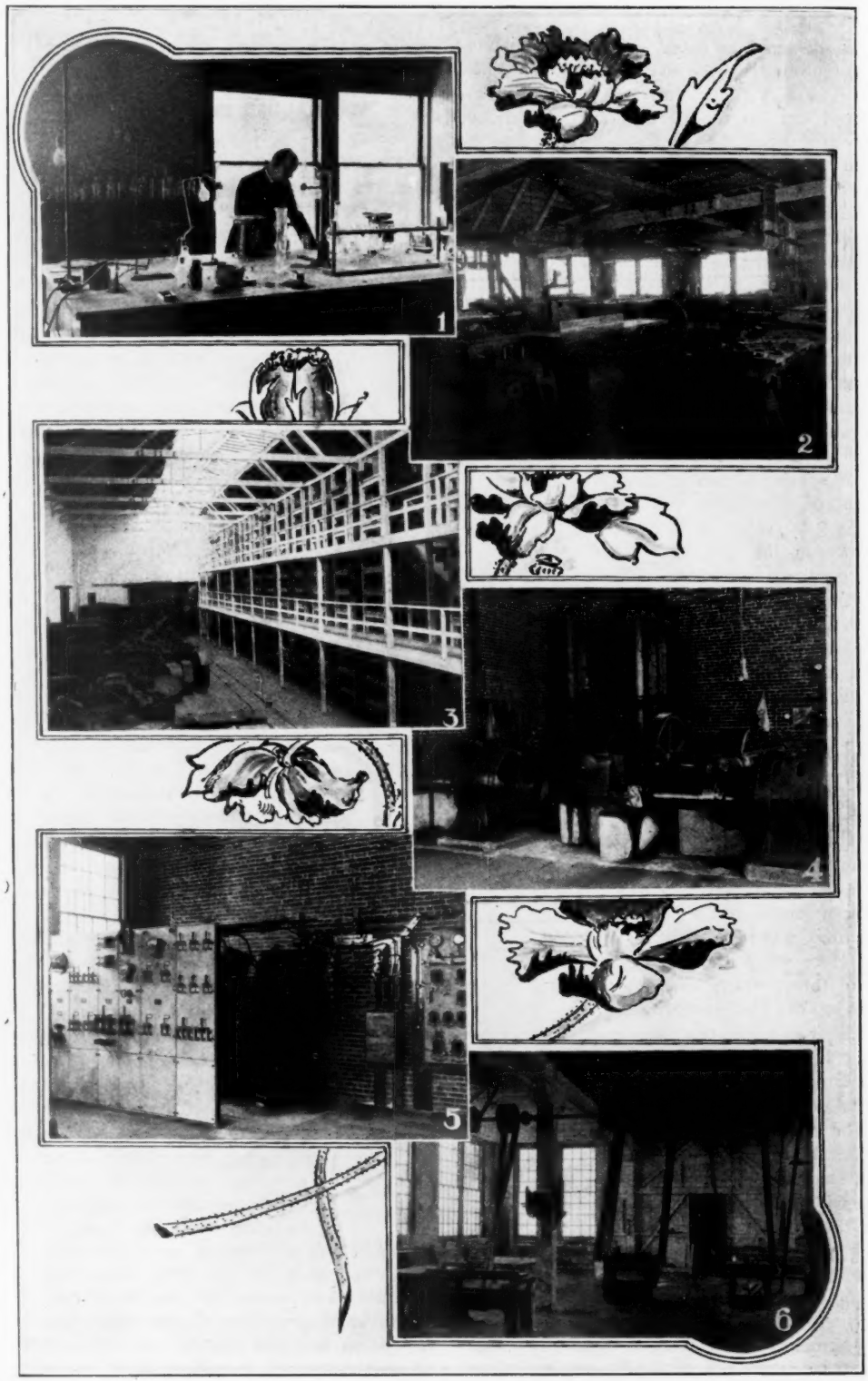
The hydraulic cylinder is cast in the same way, and if any flanges or bosses are required on the casting the pattern is arranged so that it can be drawn out of the flanges, and these subsequently drawn from the inside. The casting pit must be deep enough so that the ladle can be handled without its being too near the crane.

MANGANESE IN THE CUPOLA.

BY JOHN MAGIE.

The last number of the *Foundry* contained an article by Mr. C. H. Vannier in regard to desulphurization by means of manganese ore. The writer has made experiments in this direction at various times in the past two years spurred on by the reports of "what is being done in Germany" circulated principally by those having manganese compounds for sale. These experiments, while interesting, were not of general value since their failure might have been due to local conditions. They now become of interest however since they serve to confirm Mr. Vannier in every particular. With the writer three materials were used, high manganese pig, high grade ore and low grade ore. These were used by charging with the stock and also by placing in the ladle and tapping onto them and in no case were good results noticeable. Some slight changes took place as shown by careful analyses of each test but they had no bearing on the problem of desulphurization.

We are not able to discredit all the stories of success in this line, however, as it is entirely a matter of local conditions. It is certain that manganese ore melted with pig iron in a cupola would give off oxygen and take sulphur from the stock provided the temperature were great enough. In our American cupola practice it is doubtful if we ever obtain a temperature high enough to bring about this reaction but it may be that in Germany, where cupola practice is very different than ours, conditions are realized which make the use of manganese profitable. It would be of great value in this connection to know all the conditions under which the method is said to have been successful.



THE BUFFALO FOUNDRY CO.—1. CHEMICAL LABORATORY. 2. PATTERN SHOP. 3. PATTERN STORAGE. 4. AIR COMPRESSORS. 5. SWITCH BOARD, TRANSFORMERS AND CONTROLLING SWITCH. 6. FLASK SHOP.

A Modern Jobbing Foundry.

The so called modern American foundries, which have been erected within the past decade, have in the main been specialty shops in one form or another. Where the product of a shop is to be of uniform character one is, of course, justified in incurring greater expenditures for permanent fixtures that will help to lower the cost of castings than in the case where orders are accepted for any class of work that comes along. It is a great deal easier to lay out a foundry which is to turn out a definite class of castings than it is to meet the requirements made upon the general jobbing shop.

Another reason why the latter class of foundries are not being modernized as rapidly as those engaged in other lines lies, perhaps, in the fact that their owners dislike to tear down old works and extensions that are dear to them. It is remarkable how some of the old scare-crows of jobbing foundries really manage to make enough money to keep the doors from being closed by the sheriff. They have no facilities for handling material from molders and are often situated under the most unfavorable conditions as regards light, shop equipment and other surroundings; yet, on work, perhaps largely local, they manage to eke out a living in a way that satisfies them, and the chances are that for many years to come we shall have a large number of foundries that are a long way from modern.

Among new jobbing foundries of recent construction there is, perhaps, none more completely equipped to turn out any order that comes along than the Buffalo Foundry Co., of Buffalo, N. Y.

Arrangement of Plant.

Careful attention has been given to shipping facilities and through the New York Belt Line railway an outlet is provided which reaches all of the railways entering Buffalo, as well as the steamer lines in operation the greater part of the year. The site contains six and a half acres and leaves room for future extensions whenever these are necessary. The general view of the plant, as well as the plan, gives one a fair idea of how it is laid out. A standard gauge railway track leads to the main foundry, where castings of the largest size may be placed directly on the cars. Another spur track leads to the storage yard. A track scales is placed at the junction of the two switch tracks so that the weight of all material entering or leaving the works may be easily ascertained.

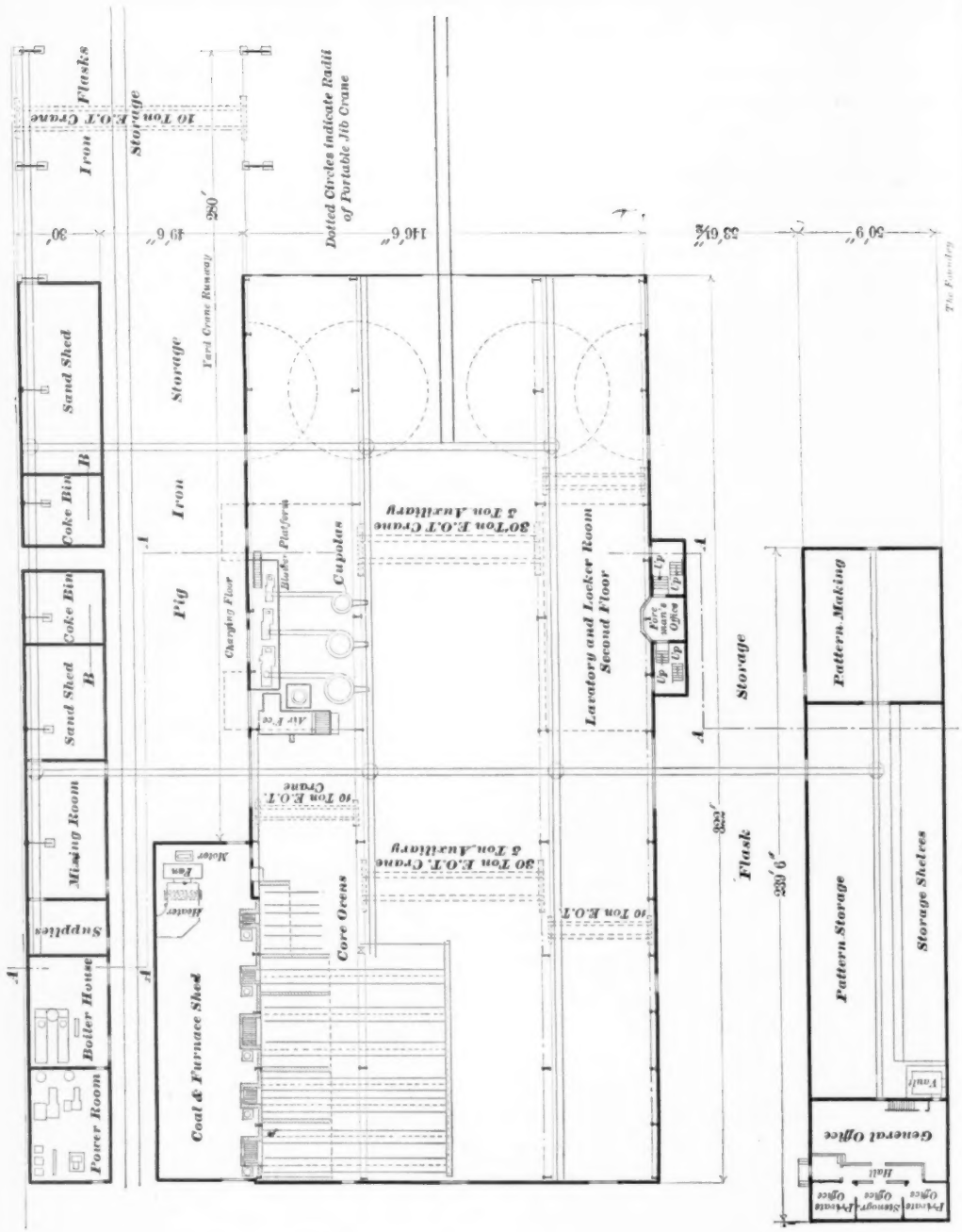
One of the first things that strike one upon visiting the plant either day or night is the amount of glass used in its construction. There are 37,000 square feet of glass in the building. At night when the plant is lighted up it seems to be made largely of glass when viewed from outside, and when one enters the plant during the day time, he is surprised at the amount of light available. The walls, ends and a large portion of the roof are of glass, but the glass used is of such a nature that it diffuses the light, thus avoiding the objection of sharp contrasts made by having the sun on one part of the shop and the remainder in the shadow.

Melting Equipment.

The melting equipment consists of three cupolas of 84, 66 and 48 inches diameter inside the lining. Each cupola is provided with a separate blower, of the Connellsville type, directly connected with an A. C. motor. At one side of the cupolas there is also a 20-ton air furnace. With this equipment it is possible for them to produce any casting that there is liable to be a demand for. The air furnace is specially designed for melting large pieces of scrap, which it does very successfully.

Charging Equipment.

The stock yard is served by an electric crane having a span of 76 feet 6 inches and a runway 280 feet long. The pig iron and scrap are kept in piles in the yard and the coke in bins. The charging is accomplished by means of charging barrows which are filled in the yard and raised by the crane to two projections on the charging floor, which extend from the side of the building under the yard crane. Scales are located in the charging floor near these projections so that all of the incoming material may be weighed. The construction of the charging floor is unique. It is made of 6-inch channels laid with the flat side up, the flanges being riveted together. The channels are supported on I-beams. When a floor is made of plates, it is difficult for the men to find footing on the large plates as they soon become worn perfectly smooth. There is just enough irregularity in the surface provided by the channels to afford footing for the men while moving the charging barrows, and at the same time the hard and partially smooth sur-

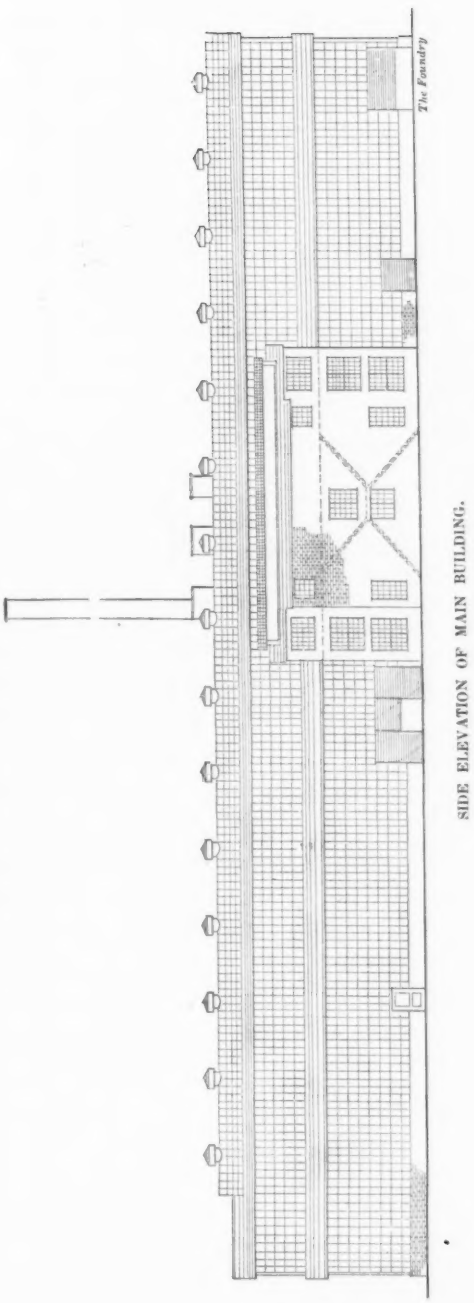


GENERAL PLAN OF THE WORKS OF THE BUFFALO FOUNDRY CO.

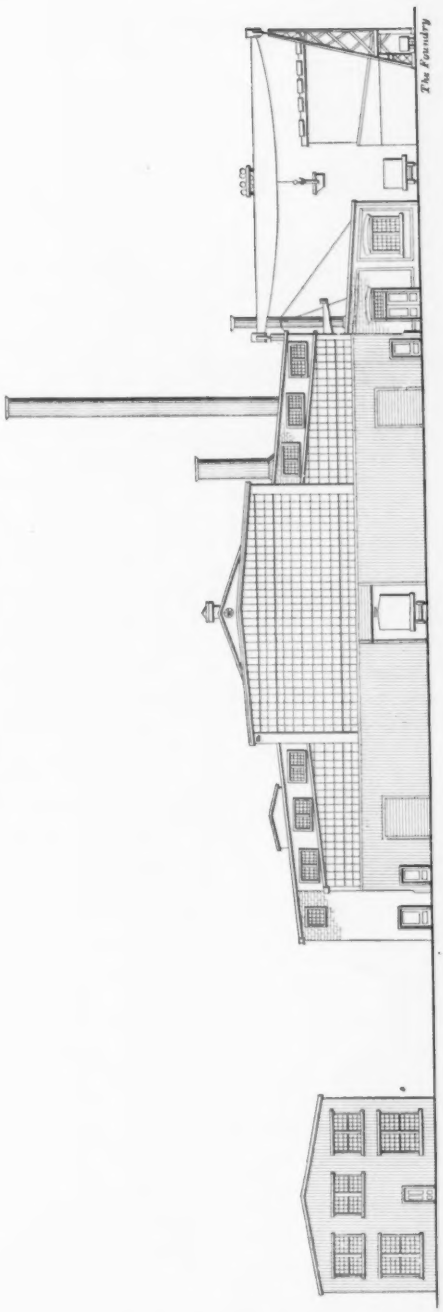
face makes an almost ideal floor for handling the charging barrows upon. The cupola doors are so placed that the material can be dumped into the cupolas direct from the charging barrows. Each cupola is provided with two doors. The charging floor is made large enough so that the loaded barrows for an entire charge can be brought on to the floor before charging commences, thus reducing the work of the men during the run.

Molding Floors.

The main foundry building is 145 x 320 feet. It is composed of three bays. The central bay and the one opposite the cupolas are given up



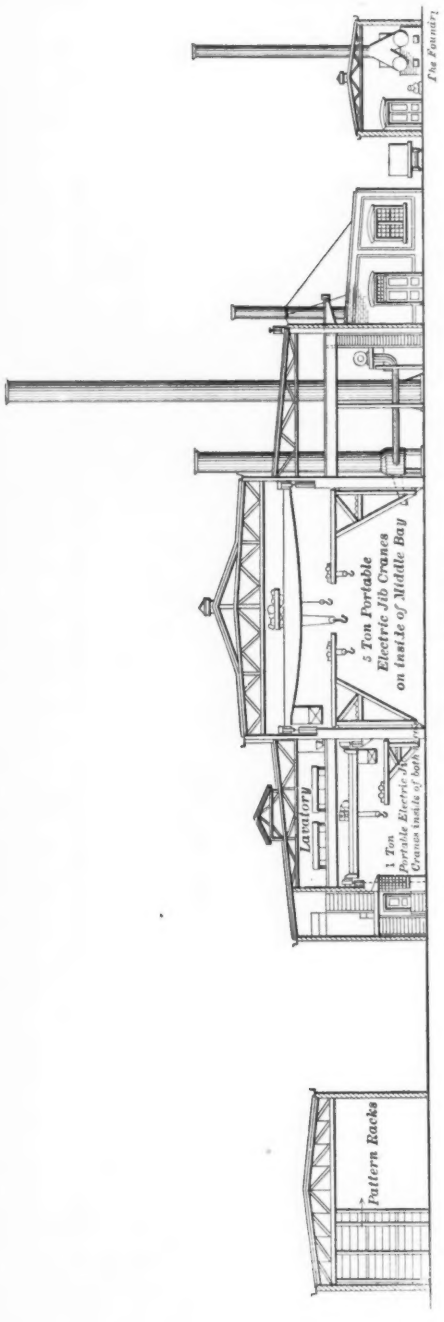
SIDE ELEVATION OF MAIN BUILDING.



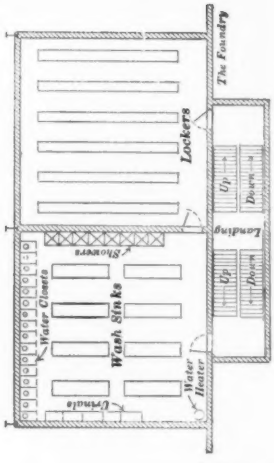
END ELEVATION.

GENERAL PLAN OF THE WORKS OF THE BUFFALO FOUNDRY CO.

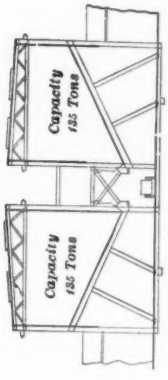
entirely to molding and the cleaning departments. The portion of the bay not taken up by the cupolas and air furnace is occupied by the core making department and a small molding floor for light work. The central floor is served by two 30-ton electric traveling cranes with 5-ton auxiliary hoists; also by four jib cranes, two of which are equipped with hoists operated by air motors and two with electric motors. These jib cranes are so arranged that the main traveling crane can move them from one post to another. The side floor opposite the cupolas is equipped with two 10-ton traveling cranes. The main molding floor has been


The Foundry
5 Ton Portable Electric Jib Cranes on inside of Middle Bay
Lavatory
1 Ton Portable Electric Jib Cranes inside of both
Pattern Racks

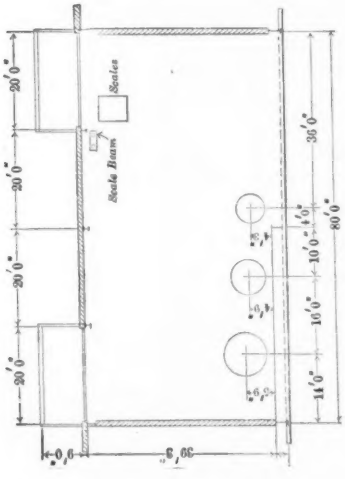
SECTION ON LINE A.A.



PLAN OF LAVATORY AND LOCKER ROOMS.



SECTION B.B. THROUGH COKE BINS.



PLAN OF CHARGING FLOOR.

dug out to a depth of 15 feet and filled in with molding sand. Before this sand became thoroughly packed they used cast iron curbs about all of their pits, but now that the floor is well packed no curbs are necessary.

Cleaning Department.

For cleaning small castings a sand blast room is provided at one end of the foundry An exhaust fan is so arranged as to remove as much of the dust as possible from the sand blast table, but as in all sand blast rooms it is necessary for the attendant to wear a helmet. One advantage of the exhaust system is that it frees the room from dust almost instantly

after the sand blast is turned off. The larger castings are cleaned on the floor at the shipping end of the foundry. The necessary emery wheels, pneumatic hammers and similar appliances are provided for this work.

Core Department.

The core department is situated in one end of the bay on the stock yard side of the foundry and at one side of the cupolas and air furnace. This department is served by a 10-ton electric crane which also serves the air furnace. There are four large core ovens fitted with rolling doors 20, 17, 25, and 12 feet wide respectively. For drying small cores there is an ordinary millet core oven with swinging trays and an oven having three compartments provided with cars carrying a door on each end of each car so that the front of the oven is closed no matter which car is withdrawn. This is really another application of the independent shelf principle, with this difference, that each car becomes a separate unit. The core oven capacity of the Buffalo Foundry Co.'s foundry may be judged when it is stated that this amounts to 30,000 cubic feet, and that molds or cores measuring as much as 25 x 25 x 14 feet can be accommodated.

For making core irons some permanent beds are arranged next to the cupolas in the molding department on the other side of the cupolas from the core department. These beds are surrounded with permanent straight edges inside of which a hard bed is made up. The patterns for the core irons are then placed on these hard beds, sand rammed around them, struck off even with the top of the patterns and the patterns drawn, thus providing open molds. It will be noticed that this method of making core irons is somewhat different from the bedding in principle used in many shops where a soft bed is prepared into which the patterns are forced.

Preparation of Sand.

Bins are placed in the yard for receiving the general stock of molding sand. Similar bins are also provided for classes of material which are not used in such great quantities. For mixing and tempering the facing sand, a reciprocating sifting and mixing machine is provided. The mixed sand is then elevated into storage bins provided for each class. From these bins it is drawn into barrows and taken to the foundry floor as required. Owing to the fact that in winter the molding sand kept in the bins is liable to freeze into large chunks, they have provided a sand thawing and drying furnace. A rat proof room is provided in the sand department for storing flour.

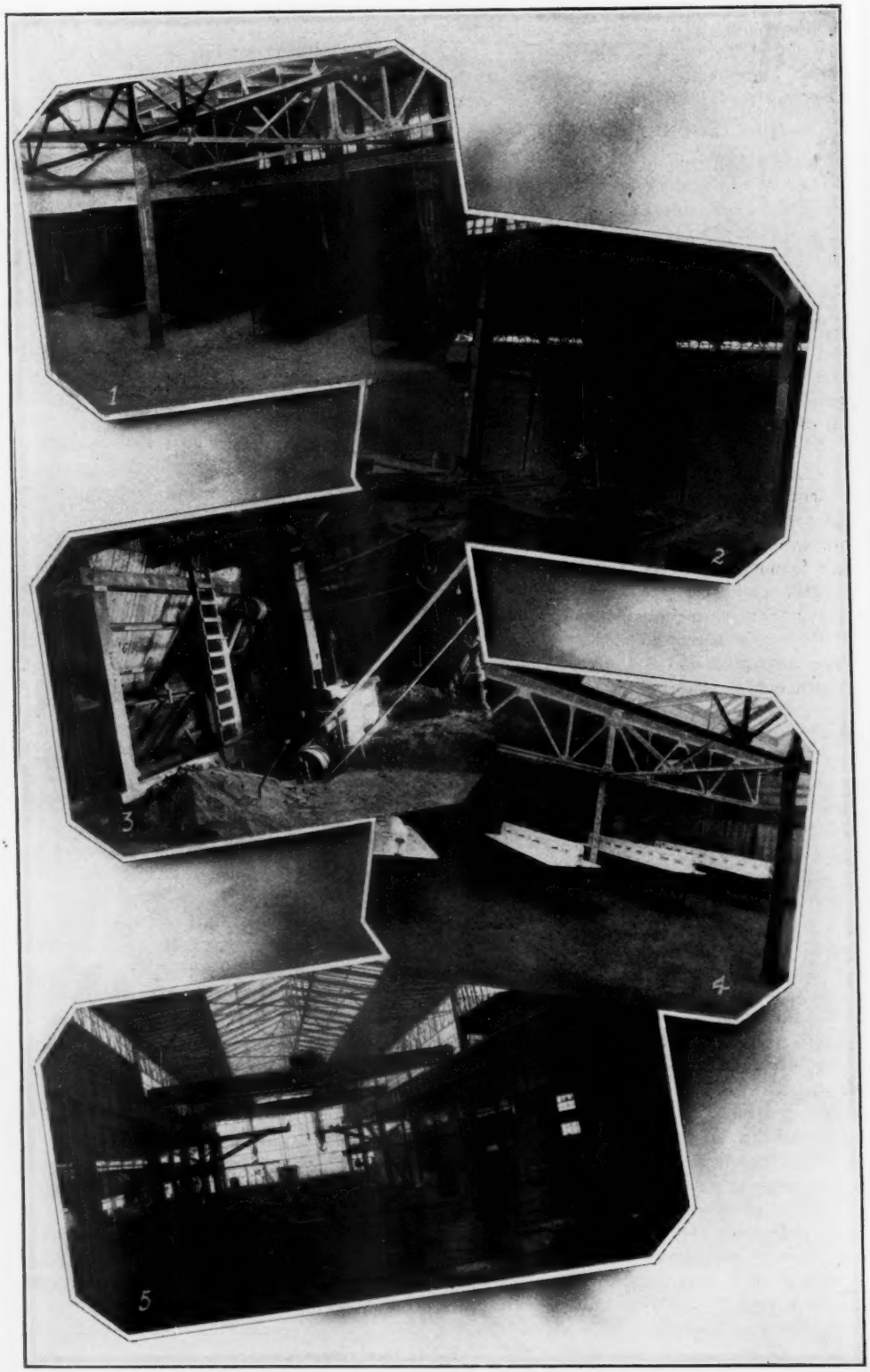
Power and Light.

The power and light of the plant are furnished by electricity from Niagara. The electricity is paid for by the meter. At times the plant utilizes nearly 500 h. p., and had they installed their own power plant it would be necessary to install boilers and engines capable of generating this amount of power; hence, they would have had to deal with interest and depreciation expenses on this large equipment. They would also have always been subject to the large friction and stand by losses incident to a power plant of this size which is sometimes operated to its full capacity, and other times only partially. By actual measurement of the electricity used they found that the average load is only 160 h. p., and this is all they have to pay for. The saving can be appreciated at once.

A current of about 2,200 volts is received from the power company and this is cut down in static transformers to 230 volts. Power motors throughout the plant are constant speed alternating current motors. The crane motors are direct current motors, and hence it is necessary to provide a rotary transformer. Two air compressors are provided, one for furnishing air for the two pneumatic cranes for the chipping hammers, etc. This compressor is driven by an alternating motor and is provided with an unloading device so that when no air is being used, only the friction of the machine is to be overcome. The other compressor supplies air for the sand blast cleaning department. This motor is driven by a direct current motor controlled by a Cutler-Hammer controlling switch which automatically stops the motor when the sand blast apparatus is stopped, and starts it again when more air is required. The air compressors were both furnished by the Rand Drill Co.

Laboratories.

All of the work carried on, including the mixtures used, is under the charge of the chemist. He has two laboratories completely equipped: A chemical laboratory for making the necessary chemical determinations, and a physical laboratory for the physical tests. In the physical laboratory they have a 200,000 pounds Riehle testing machine. This equipment and the careful manner in which the work is conducted at the plant enable them to fulfil difficult specifications very easily.



1. LOCKER ROOMS. 2. SOME OF THE LARGE CORE OVENS. 3. FACING-SAND MIXING DEPARTMENT.
4. WASH ROOM. 5. MAIN BAY OF FOUNDRY.

Pattern Department.

The pattern department is located in a building parallel with the main foundry building. The offices and laboratories are at the front of this building; back of them is located the pattern storage. One-half of the pattern storage is provided with pattern racks for the storage of the smaller patterns. These patterns are kept track of by a card index system. For the present the other half of the building is used for storing the larger patterns upon the floor. Care has been taken in most of the buildings to furnish fire-proof or slow-burning construction. Owing to the fact that a pattern storage is sure to be full of highly combustible material, they have made no attempt to make the building especially fire-proof, but have constructed a light wooden roof which would burn off quickly and allow access to the fire. The pattern shop is located at the other end of the pattern storage building from the office. It is situated on the second floor and is equipped with the best pattern making machinery. As they conduct a jobbing foundry purely, most of the patterns used are constructed by outside parties, and hence it is not necessary to keep up as extensive an equipment as would be the case were they manufacturing any special line. Nevertheless, the equipment installed is of the best and they are in a position to make patterns when required.

Flask Department.

Under the pattern shop is located the flask department where the wooden flasks used in the foundry are made. This department is equipped with a full line of wood working machinery necessary for the work.

Heating Equipment.

The plant is heated and ventilated by the Buffalo Blower Co.'s heating and ventilating system. Two boilers are installed next to the air compressor room for furnishing steam for the heating system. As all the power about the plant is furnished by electricity from Niagara it is only necessary to fire these boilers during the portion of the year that heat is required in the plant.

Sanitary Arrangements.

A wash room is provided for the men, having basins, equipped with hot and cold water fixtures, shower baths and the necessary toilet equipment. Adjoining this room is the locker room provided with expanded metal lockers so that each man can have an independent locker.

THE TOP OF A GREEN SAND MOLD.*

BY THOMAS D. WEST.

In considering the top or cope surface of a green sand mold, we have to treat of means for suspending bodies of sand in a stable form, the degree of dampness, density of sands as well as the question of open or closed risers.

In presenting these subjects it is not to be excepted that all the points presented will be strictly new to those of large experience in the actual work of the molder, nevertheless there are many connected with foundries that may derive a better knowledge of principles by this than otherwise. Then again, almost every molder of large experience has his own ways of doing things, or ideas of methods, and for this reason the paper should provoke a discussion that might prove of value to many.

In treating the first topic we can be best impressed with its importance if we will imagine a pile of sand on one hand and the top forms of some large molds on the other. It is as natural for sand to maintain forms in bottoms of molds as it is for the water of Niagara to flow over its falls, as was clearly shown by one Pat, who, when asked if he did not think it wonderful, replied, No, he did not see anything to prevent the water falling. It seems to us in looking at the under sand surface of a large suspended cope, that man is thwarting nature's laws, or, according to Pat, is doing something wonderful.

Conceding it an achievement to suspend bodies of sand, the point next in order is how to do it. To undertake such work intelligently, we should first know the weight of rammed sand, and secondly, the largest body that can be suspended within four walls. Tests show that on an average a cubic foot of rammed sand weighs about 100 pounds and that it can be suspended in bodies ranging from 14 to 18 inches square by 4 to 6 inches deep, the deeper the body the greater area carried. While it is true that rammed sand can be suspended to the dimensions just cited, conditions vary the size to be used. In some cases one could safely utilize bodies having an area of 14 to 18 inches square, while in others not much over one-half this area could be safely used. This is chiefly controlled by the area of the casting to be made, whether there are any bodies extending below the joint to be lifted and the head pressure of metal when pouring the molds.

*Read at meeting of New England Foundrymen's Association at Boston, Mass., Nov. 11.

In cases where the area of copes exceeds 14 to 18 inches square they are sub-divided by what we term cross bars, and give us what might be considered sub-pockets. These divisions vary in form, the one of greatest utility being oblong, as by this form larger areas can be suspended than by square ones. As an example, a space 6¾ x 48 inches can be rammed to far more firmly suspend a body of sand than one of the same area put in the form of 18 x 18 inches. This illustrates a principle in cross barring copes, that if kept in mind would greatly decrease the number of "drop outs" or the release of suspended bodies in handling copes, or pushing the sand up out of the bars when molds were poured, thereby causing bad castings and heavy losses.

Gaggers and Soldiers.

To assist the cross bars in suspending bodies of sand, we have recourse to what are termed "soldiers" and "gaggers," with which all foundries are familar. When and how these should be used are points that can here be profitably discussed. A "soldier" or "gagger" should be used only in cases where they are necessary to aid in the suspension of bodies of sand, or to assist in preventing the "drawing down" of cope surfaces, as their use is liable to cause an uneven surface or blow holes, on the cope side of light castings. While they are a necessary evil, there is much work that demands their use, in fact it is always best when in any doubt as to their being necessary to take the safer course and use them.

The question could be asked, which is best, "soldiers" or "gaggers?" This depends upon conditions; a "soldier" if the same length as a gagger can suspend a greater body of sand, for the reason that its sides offer greater surface for the hanging sand to adhere.

The work most largely dispensing with the use of "soldiers" or " gaggers" is such as "stove plate." Here the faces of the bars A are evenly chamfered as at C, Fig.1, and brought within ½ to ¾ inch of the face of the pattern B. In some cases where inferior sand is used the faces of the cross bars may have nails driven into them every 2 to 3 inches apart on both sides, or one row in the center after the manner seen at C. Some shops other than those making stove plate, etc., adopt this nailing plan in some work in preference to using gaggers. The chief objection to this lies in the projecting nails being hard on the fingers when "tucking the bars," also in the liability of molders to neglect the "tucking" on account of the nails hurting their fingers. Such neglect will leave soft spots under the bars in the cope surface which cause swells on the castings, if they are not pressed down and filled up with sand when finishing the cope.

In Fig. 2 is displayed a few good and bad practices in setting gaggers. At No. 1 is seen a gagger coming up but a short distance between the cross bars, while at No. 2 it extends the full height of the bar.

One might think any workman of intelligence would not set gaggers as shown at No. 1, nevertheless molders can be found almost every day in foundries using gaggers, setting them after the plan shown. A gagger or soldier, to be reliable in suspending bodies which protrude below a joint, should extend fully two-thirds its length up between the bars as seen at No. 2. One would stand a better chance to lift a body as at D without using gaggers than to set them like No. 1 for the simple reason that the space occupied by the gagger is heavier than if it was sand, and there is no pressure to hold the gaggers between the bars.

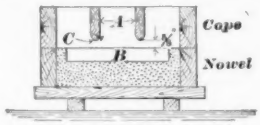


Fig. 1

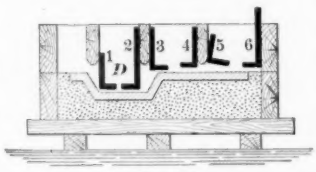


Fig. 2

At Nos. 3 and 4 are seen examples of practice followed in setting gaggers on sand sieved or placed over the face of patterns, wherein one is nearer the pattern than the other. Some work intelligently in this, while with others it goes as it happens. Where castings are heavy, and especially if there is any liability of the sand drawing down, it is generally advisable to have but about ¼ inch thickness of sand under the gaggers, whereas with light or thin castings ½ inch thickness is best, as by this a better chance is afforded the escape of gases and the avoidance of hard spots which often cause defects in the cope face of thin castings. These are also often caused by the careless practice many follow of having a lot of flour paste or lumps of clay sticking to the toes of gaggers when setting them onto the sand covering the face of the pattern. This causes mud spots and readily produce defects in the cope surfaces of thin castings. If proprietors and

managers would notice these points in their passage through foundries to let molders know they knew what was bad practice in this line, there would be far less bad work due to these ignorant or careless practices. We could proceed to mention other evils in setting gaggers, but as time is limited, I will take up the question of dampness and density in relation to sands for ramming copes.

Dampness of Sand in the Surface of Copes.

There is considerable difference required in the treatment of sand for ramming copes and in forming the bottoms of molds. One peculiarity lies in the difference of freedom for the escape of steam, and which can be illustrated in a radical manner by imagining the different results in pouring molten iron into a ladle having water on its bottom and by pouring water on top of a ladle of metal. In the first case we would have an explosion that would shake the earth and scatter the metal in all directions, and in the other case no evil results other than a free escape of steam and a little dulling of the metal surface. This is so harmless that I often when in a hurry to cool off the metal in crane ladles, to get the right temperature for casting, pour one or more pails of water on top of the metal. The only thing to guard against in doing this is not to press the chilled crust under the molten metal to melt it before all signs of dampness on the surface of the crust have disappeared. It is not to be understood by this that we can in all cases have the top surface of molds excessively damp or approaching a muddy condition. There are cases, however, when we require the extremes of dry and wet sands more than in the formation of bottoms. These extremes are to be found in light and heavy work, and are due in the case of light work to the sudden contact of metal against a large surface, while in the case of heavy work it is due to the exposure of large suspended surfaces to high heat. To illustrate the first we will take the case of large boiler fronts. In pouring such castings the metal must as a rule be rushed in with all practicable speed, and in castings over ¼-inch thick the metal flows over the bottom in a thin body until it is all covered; it then arises in a fairly uniform body until it strikes the cope surface and pops up the risers to denote the mold is filled. The filling of such molds and lighter ones is so sudden there is little time given for the escape of steam or gases, and hence there is greater need of precaution in preventing their creation and providing means for the free liberation of what may be formed.

It will be noted that I have used the terms steam and gas. While moisture, a compound say of two parts of hydrogen and one of oxygen, gives a gas that will burn, as can be seen by the blue flame when throwing water on a cupola bottom, I make a distinction on the grounds that steam is due to moisture, while gases are due to the minerals in the sea coal, facing and the sand. While it is true that we have the gases from both steam and minerals to contend with, their actions are of such a distinct nature we should consider them as separate agents in order to attain correct conclusions in fathoming ill results due to their existence.

In considering the amount of gases that can be created from the minerals, sand and moisture contained in a mold it is but a step farther to perceive the necessity of creating as little of these gases as possible and providing a rapid exit for their escape.

When the gases are excessive and confined, we experience defects in the cope surfaces of light castings, much more so than in medium or heavy ones. These defects may be in the form of wavy rough surfaces, smooth concave indentations, corners, edges and plain parts not running full to the shape of the pattern, and "cold shuts." These defects are caused by the steam or gases forming a cushion between the mold and metal, and are aided by dull metal. The hotter the metal the longer time afforded the gases to escape before the metal sets or solidifies. To avoid these defects we must use the sand as dry as possible, ram it after the manner to be shown and use the vent wire freely in connection with good hot metal.

"Drawing Down" and Skin Dried Copes.

Having shown the necessity for using sand as dry as practical, we will now show wherein the reverse is advisable, and which lies in the making of heavy castings having large cope areas that will be exposed to the direct heat of metal during the time a mold is being filled. Take the case for instance of making a casting 4 to 6 inches thick by five or more feet square. Here, from the time we start pouring until the mold is filled—from one to four minutes—the top of the mold is exposed to the intense heat of the rising metal, and should a mold be poured short to wait for iron, it might be exposed for five to fifteen minutes. A conception of the heat which such cope tops have

to stand can be had by considering how a flat body of green sand would be affected were it suspended a few inches above the surface of a large ladle of hot metal. It will be evident that the heat from such a body must be very effective in drying the surface sand exposed to the heat of the metal. This is found to be the case in the daily practice of making heavy castings, and has resulted in causing much bad work and in originating the technical term "drawing down," which in a literal sense is the dropping down of sand that has been dried by the heat. Molders without experience in making heavy castings, have upon starting found the top surface of their casting to come out with large flat lumps, and the sand which came from these places floated off to form depressions or cavities in other sections. Some molders have gone on making casting after casting and unable to remedy such defects, these flaws in some cases would send the castings to the scrap pile causing heavy losses. To overcome this evil the sand used for the first inch or so on the top face of the mold must be of such a character, that instead of the intense heat drying it to a dust form, it will bake it to form a hard crust, that by being closely gagged or surface nailed as at E, Fig. 3, will not separate from the damp sand above its surface. To achieve this the sand used should be of a loamy or clayey nature, and bake hard when heated. Some localities can obtain sand that is suitable without the mixture of any other material for this work, while others must mix flour or clay wash with their sand in order to obtain a facing that will bake when heated. As a rule all this facing sand must be made much damper than that used for light castings, and aside from starting with a much damper sand, it is often a good plan in case of very thick castings or those exposing the top or cope surface over one minute to the heat of the rising metal to dampen the finished cope surface with water, or better still, mixing half a pint of molasses to about two or three gallons of water and applving it with a sprayer or brush. The surface can in that manner approach a mud and work all right for very thick plate castings, long in pouring, but which if attempted for light or quickly filled molds would cause a boil or explosion that would throw most of the iron out of the mold and endanger the workmen.

Another plan often adopted is to "skin dry" the top or to use a loam plate covering. The first is obtained by making the facing of strong loam sand or mixing weaker sands wit" flour or clay wash and wetting the rammed or finished surface to make it very damp for a depth of ½ inch or so and then building a fire under the cope with shavings and fine wood or gas to "skin dry" the surface to a depth of ½ to ¾ inch. This is done chiefly where the cope surface is to be exposed a long time in pouring or where sands are very weak and the mold will be filled quickly, the former causing fear of the sand "drawing down," and the latter because if left damp or of a loamy nature there would not be time for the rising metal to dry the surface sufficient to prevent the metal boiling and make defects or a bad casting. In such cases it is often best to surface nail the copes as at E, Fig. 3, in conjunction with the setting of gaggers, as with the use of weak sands there is great danger of the "skin dried" thickness parting from the green or undried upper body of the sand and by surface nailing the dry and green are held together.

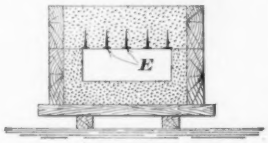


Fig. 3

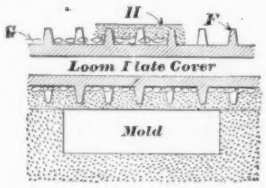


Fig. 4

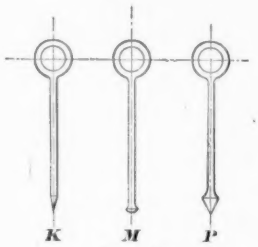


Fig. 5

Loam plate covering is used only in copes for massive castings or those long in filling where the best assurance of preventing "drawing down" is desired. This is made by casting plates with prickers, as at F, Fig. 4, and after covering the surface with fine cinders as at G, the cinders are then wet with clay wash and a strong mixture of loam, wet to a mud state is then packed on as at H, after which the whole is thoroughly dried in an oven or otherwise.

Density of Sand in Rammed Copes.

In ramming copes, we have much the same conditions to contend with that are found in bottoms. A cope 6 to 8 inches deep is best

rammed by making two courses. The first course should not be over 4 inches deep, and the ramming of it by the pein should be done in a regular, close, even manner, so that the surface will be alike in density. The second course of sand is first rammed by the pein and then by the butt. The second peining can be done in about half the time required for the first course; all that is necessary is to press the pein down solidly to feel the first course in spaces 2 to 3 inches apart, whereas the first course requires all parts of its body penetrated with the pein. After the second peining the butt end of the rammer is used, and upon this dependence must be most largely placed for obtaining the density necessary to maintain the sand between the cross bars while handling the cope and pouring the mold. Some, in ramming copes under 8 inches deep, will avoid the second peining by putting in the greater depth of sand for the first peining and finishing with the butt. With copes 4 to 6 inches deep this may often answer, but with those of 6 to 8 inches deep the plan is not as a rule a desirable one to follow, as it does not afford the chance of obtaining the even density or degree of hardness of the face secured by the two peinings.

To hold the sand reliably in a cope, the butting is of the greatest utility. It not only packs the sand most solid, but also saves time and labor. It is used but once, no matter how deep the cope, or the deeper the cope, the more courses of peining, reserving the butting as a rule for the last course.

The surface of light work copes should be softer than with heavy work, and either class will require harder ramming on the face to a certin limit, according as the height of head pressure is to increase in pouring the mold. Two thin castings having the same density of cope surface, but one having a higher head pressure than the other, would differ in thickness, although made off from the same pattern.

Venting and Vent Wires.

The methods used for venting copes are regulated by the density and dampness of the sand, also class of work being made. Light work copes should for plain plate work have the vent wires pushed close to the surface and not over one inch apart, while with heavy plain plate work, the vents are best kept wthin ½ inch of the surface and may range from 2 to 3 inches apart. Where there are projections, closer venting will be required in heavy as well as light work. The advantages of close and distant venting will be understood as one considers the reason given herein for the liberation of gases.

The sizes of vent wires used range from ⅛ to 5-16 inch, the larger wire being used for heavy work and the deeper the venting or cope the larger wire necessary. A feature that will strike some as being unscientific and will be new to many, lies in the difference seen in the points of the vent wire at Fig. 5. A novice in their use would select K as the one to offer the least resistance to force when being pressed into the rammed sand. A trial of both K and M will surprise the novice; much less force is required to press M than K. Some, to obtain advantage of the point feature, combine the two to have vent wires appear as at P, but the point in use does not have the ease that one would think it should. However in the case of wires over ¼ inch diameter, P is a good form to adopt.

Open and Closed Risers.

In treating the question of open and closed risers, we take up a subject on which molders do not agree; one or two writers hold that all risers should be kept open, while others maintain that much depends upon conditions, the writer taking sides with the second opinion.

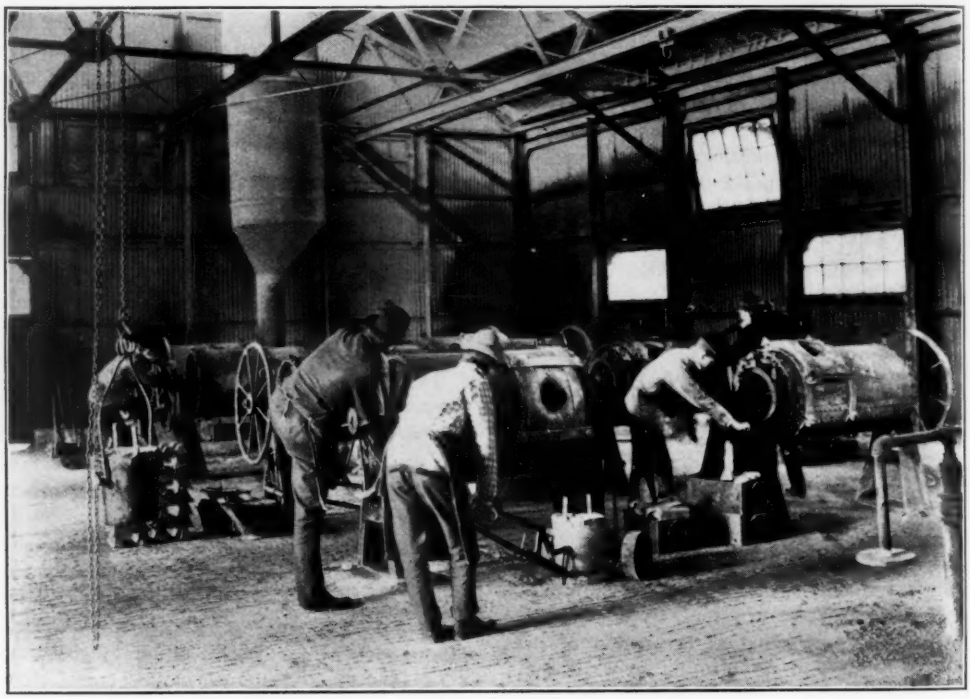
The action of risers, closed or open, is in the former case an action which maintains a pressure of air and gases between the surfaces of the rising metal and the cope, while in the latter case there is little or no pressure, accompanied with the friction of air and gases rushing through the mold to escape out of the risers. The benefits of free escape for the air and gases through venting and open risers lie in removing chances of gas cushions which might prevent the metal filling all corners, edges and plate parts of molds, cause blow holes, etc. The benefits derived from keeping all risers air tight are in maintaining an air pressure in molds that will aid in sustaining the suspended bodies and prevent the escaping air or gases disturbing pieces of the mold, lodge blacking dust and dirt under projections, etc., or be carried out of the mold, and is a manner to be compared to what would occur if one could open and close the mouth of the volcano or in a milder way the difference in the commotion of air that prevails in and out of doors during a wind storm.

The commotion of air and gases in light work molds, aside from carrying dust, can do little harm for the reason that there is little body of metal and molds are quickly poured.

whereas in heavy work we have the reverse conditions. The statement has been published in the *Foundry* that all green sand molds could be cast with open risers. I am afraid that the writer making that assertion has had a limited experience. I think I could give him green sand jobs and he could not obtain perfect castings by having open risers. I believe that another writer claimed that the face of heavy plate work was not rammed hard enough. It is true that hard ramming and good close venting may make it possible to cast certain lines of heavy plate work with open risers, nevertheless I fail to perceive wherein anything is gained in casting such work with open risers, and if there is not anything to be gained, wherein lies the advisability of taking dangerous chances?—an evil which lies chiefly in the danger of "drawing down" with plain plate surfaces and disturbing delicate bodies of sand in complicated designs to start a mold to blow, which when once begun often permits the metal to come in contact with rusty nails and rods and fills vent passages for the escape of gases with metal, causing a mold to resemble a live volcano.

THE LUNKENHEIMER MELTING FURNACE.

The Lunkenheimer company carried on a series of experiments extending over several years, in order to determine the form of melting furnace most suitable for its work. It finally evolved the form shown in the accompanying illustration. This furnace has a number of unique features. Probably the most unique feature is the plan of providing the furnace with two charging holes. As in this style of furnace the flame and gases escape through the charging hole and as the metal is also poured out through this hole, the wear on the lining at this point is naturally greatest, and with a single charging hole it is frequently necessary to replace all or the greater part of the lining when this portion becomes seriously worn. In the Lunkenheimer furnace one of the charging holes is plugged with fire clay until the lining about the other becomes seriously burned away. The hole which has been in use is then closed with fire clay and the other one opened, thus doubling the life of the lining.



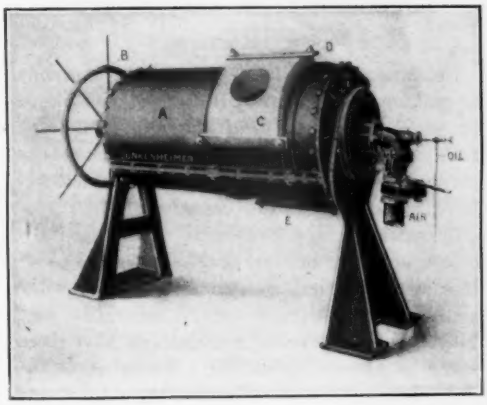
A GROUP OF LUNKENHEIMER MELTING FURNACES.

The shell containing the lining is made in halves and bolted together so that one-half

of it can be removed when relining the furnace. The interior of the cylindrical portion is lined with wedge shaped fire brick or tile. Special tile are used about the charging openings and also for the ends of the furnace, the tiles for the ends being in quarters.

In replacing a lining, the shell is taken apart, the old lining removed and the special tile for the charging openings placed in position and the two halves of the furnace bolted together. One end is also bolted in. The lining is then placed in position, the tiles for the open end being placed last. After this, the end is bolted in place and the furnace is ready for placing in its housings.

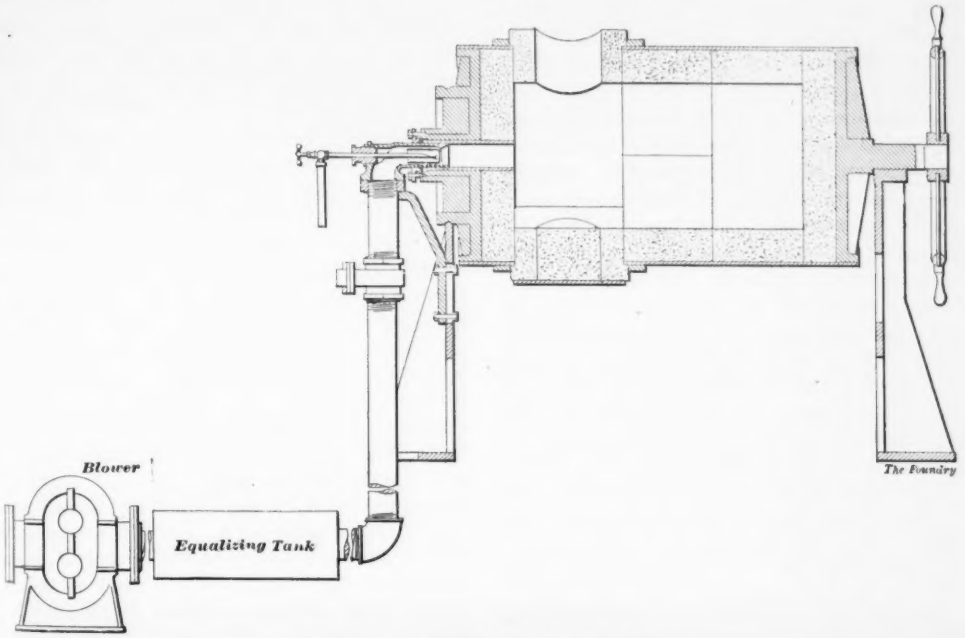
The oil burner used is of a special type, designed to give the greatest amount of heat with the minimum consumption of oil. In its own foundry, there are 10 of these furnaces in use, as shown in the illustration. From six to seven heats per working day of 10 hours has been the average output of the furnaces. The weight of each heat will average about 550 pounds. The oil consumption varies from two to two and one-half gallons of crude oil per hundred pounds of metal melted. The life of the linings is from 300 to 400 heats, varying with the kind of metal melted. On account of the simple form of the tile used it is very easy to reline the furnace.



SHOWING BOLTING OF SECTIONS.

It has now placed the furnaces on the market and with the first one sold to each consumer within a radius of a thousand miles of Cincinnati it will send an expert to take off the first heat and instruct the purchaser as to how to obtain the best results from the furnace.

The employes of McKinney's iron foundry in Albany still keep up the interesting old English custom. On Christmas Day the workmen gather at this plant and sing glees. This year the men met in the pattern shop for their annual celebration.



SECTION OF LUNKENHEIMER FURNACE.

SIDEBLOWN STEEL CONVERTERS.*

BY N. LILIENBERG.

Steelmakers are divided as to the economy of making castings from Bessemer steel blown in small converters with horizontal tuyeres. Large amounts of money and work have been spent on experiments and some manufacturers have discarded the process after it had been duly installed and operated. This naturally causes others to hesitate and hampers the progress in the whole. Everything depends on the method being carried out in the right way. Most of the previous publications have been made by agents advocating a special construction, claiming all possible advantages for it and hiding the disadvantages. I am agent for no steel process and will try to take the independent stand of a manufacturer investigating whether it will pay him to erect such a plant. It is of course impossible to exhaust the matter entirely, because a number of people are working with improvements, which may change the aspect after a while. In gathering information I am especially indebted to Mr. Bradley Stoughton, of New York City, who has made many investigations in this line.

The Markets for Different Castings.

It has been generally conceded that the superheated steel made in side-blow converters cannot compete with open-hearth and bottom-blown steel for heavy castings and for ingots to be rolled and forged. The field at present mainly assigned to it includes castings of light weight, thinness and of ornamental designs. Side-blown steel has a place between crucible and open-hearth steel. The castings have mostly no higher carbon than 0.25% and it would be too expensive to melt such steel continually in crucibles.

In a general way it may be said that small castings from superheated steel may compete with cast iron, malleable iron, drop forgings, pressed steel and bronze. The competition with cast iron can only take place in cases where lighter weight with the same strength is desired. This is especially the case with naval constructions and with running machinery; thus, with wheels of all kinds, cogwheels, pulleys, small truck wheels, etc. The competition with malleable iron will depend on many local circumstances. That process can only penetrate to a certain depth and takes a comparatively long time, in both of which the steel has the advantage. On the other hand the castings of malleable iron are more easily made and the sink-heads and gates are much easier to remove and dispose of. There is undoubtedly a field for competition with drop forgings for a numerous variety of soft steel tools and other objects. These must, however, be limited to cases where no special strength is required, because a drop-forged article made from rolled steel is undoubtedly stronger than a steel casting. The same thing applies to cold-pressed sheet which has of late come into extensive use. In ornamental castings bronze of course takes the lead, but many objects are made of cast iron and painted bronze. There are, however, some lower limits beyond which it does not pay to make those small articles of cast iron, and here soft steel can take its place. It is doubtful if such steel will come into use for stoves, as cast iron properly constituted will fill out all the ornamental designs required and no special strength is needed.

Dynamo Magnet Steel.—It has proved possible to produce superheated side-blown steel entirely sound, uniformly lower in carbon and manganese than any open-hearth or bottom-blown steel. As the manganese is, above everything, objectionable to the permeability, many tests have shown that with the ordinary magnetizing force it has been possible to increase the induction about 10 percent by using the above named steel. This is what is claimed by M. Tropenas in a pamphlet that has been corroborated by outside impartial parties. The permeability and hysteresis curves from such steel in fact approach those of Swedish iron.

Centrifugal Castings—The many devices to make steel castings hollow in a rotary mold have principally met with the obstacle that a large quantity of open-hearth steel cannot be kept liquid long enough for casting, rotating and removing hollow ingots. But it seems to me that the question could be brought to life again now that superheated soft steel can be obtained in small quantities from side-blow converters. Having made some investigations in that matter, I hope to return to it on another occasion.

Ingots for Rolling or Forging—As far as I know these are not regularly produced in appreciable quantities from side and surface-blown steel. It is impossible for a two-ton converter to compete in cost of production with large sized bottom-blown or open-hearth furnaces. There are, however, cases where it seems to me advisable to make ingots in that way.

*Extract from a paper read before the Philadelphia Foundrymen's Association, Jan. 6, 1904.

Hard Steel—As far as I know the bulk of the side and surface blown steel has carbon not above 0.25 percent. I have not heard of any instance where higher is produced in that way by breaking off the process earlier, but there are some cases where recarburization is accomplished by additions after the blow for such purposes as spring and common tool steel.

Uniformity in Chemical Analysis.

It has been claimed that side-blown steel runs more uniform in composition than open-hearth steel. I give here below some comparing analyses of steel castings made by the acid process, the figures reported being taken from consecutive charges and not selected:

OPEN-HEARTH STEEL, NEWARK, N. J.

Crucible Steel Co. of America.

C	.31	.26	.21	.26	.33	.40	.41	.41
Mn	.47	.74	.45	.74	.75	.74	.55	.56
Si	.25	.28	.22	.25	.28	.34	.30	.28
P	.048	.051	.058	.071	.025	.060	.058	.045
S	.027	.027	.030	.054	.030	.030	.036	.028

SIDE-BLOWN STEEL, ST. PAUL, MINN.

American Hoist & Derrick Co.

C	.27	.28	.26	.28	.24	.24	.24	.25
Mn	.78	.81	.76	.76	.97	.78	.82	.75
Si	.25	.28	.23	.29	.26	.23	.25	.21
P	.051	.050	.049	.051	.048	.053	.052	.045
S	.034	.039	.033	.037	.024	.033	.039	.039

It will thus be seen that the carbon is somewhat more uniform in the side-blown steel but that otherwise the variations in the elements are about the same. The high and variable percentage of manganese comes of course mostly from the addition of ferro-manganese.

A metal free from manganese, for electrical purposes, can only be produced in side-blown converters by continuing the operation until the carbon is about 0.10%. Steel thus produced has analyzed in average:

Carbon 0.10%
Manganese trace to.....0.04%
Silicon 0.02%
Phosphorus 0.04%

Some very mild bottom-blown Bessemer steel has been produced especially at Homestead and Bethlehem Steel Works, the carbon going down as low as even 0.07% and the silicon about 0.010% (in some cases even 0.004%) but the manganese is at the same time up to about 0.40%. The pig iron to used for the side-blown coverters need not contain over 1.5% silicon as so much extra heat is obtained by burning the carbonic oxide inside the converter. This is an advantage considering that silicon is an expensive fuel for the converter.

The manganese in the side-blown pig iron should not exceed about 0.50% as it would among other things greatly increase the heavy wear of the lining.

Mechanical Properties.

It has been claimed that side-blown steel invariably is absolutely sound and free from blow holes. This ought to be modified so far that the metal is generally sounder than open-hearth or bottom-blown steel; but by wrong manipulation it is quite possible to produce honeycombed steel by side-blow. That it is generally dead molten depends mostly on the great fluidity which allows the gases to escape and not on the fact that no air is driven through it. The results from pulling tests of side-blown steel do not in average indicate any superiority over good open-hearth or bottom-blown steel of same composition. The annealed side-blown steel castings whereof analyses have been given above with carbon 0.24 to 0.28% show mechanical properties whereof the following extracts may give an idea:

Elastic limit.....29,350 to 42,900 lbs. per sq. in.
Ultimate strength..63,800 " 71,900 " " " "
Elongation .....38.50% to 28.%

Just as with other steel the annealing and forging improve the mechanical properties. Very good cold-bending tests have been shown of side-blown steel but it has not been demonstrated that other sound steel of the same composition and treated the same way cannot stand the same tests.

Advantages of the Small Converter.

When the question confronts the manufacturer whether he ought to erect a plant for making side-blown steel, the first thing to be considered is his facility for marketing the products. I have said that for electrical purposes a new metal is produced simultaneously low in carbon and manganese. Outside of that the advantage is not in the quality but in the greater possibilities by obtaining superheated dead molten metal in small quantities. The bottom-blown converter can produce small castings with the first part of the charge but it takes so long to pour out the steel in that way that the metal would be too cold at the end of the pouring and heavy skulls formed. The open-hearth furnace cannot produce steel hot enough for small steel castings without a great deal of expense in refractory material. On account of the high temperature of the metal from side-blown converters it can be poured over the lip from small ladles in the same way as ordinary cast iron from a cupola without leaving much skulls. It has even been found

by some steel makers that side-blown steel cannot be tapped from the bottom by a stopper because the lining is cut out from the tap hole.

I quote below literally three advantages from Mr. Bradley Stoughton's valuable paper on the subject:

"The plant of side-blown converters is cheaper to install. The first cost of an open-hearth furnace is much more than that of a converter plant, but thereby has to be taken into consideration, that on account of the length of time necessary to repair a converter with fixed bottom and because these repairs are necessary every 20 heats on the average three vessels must be installed to keep one working continually for at any one time one converter is working one is repairing and the third is drying. A plant of three two-ton converters would thus replace an open-hearth furnace of from 50 to 70 tons daily capacity. The blowing engine and motor are of course much cheaper than for a bottom-blown converter. Any blower of the two impeller type capable of giving the necessary wind may be used.

"The converter may be shut down and started up at short notice. An open-hearth furnace must be run continually to be at all economical, while the chief additional expense of running the converter intermittently is the small amount of fuel to heat up the apparatus before the first blow. This advantage, however, only applies to the following limited classes of manufacturers:

"1. Those who have ample room and prefer to do their work by daylight.

"2. Some cast iron and malleable iron founders, who are frequently called upon to furnish steel castings to good customers, but do not have a large, regular or steady demand. Under these circumstances they are wont to sublet such contracts to steel foundries with the result of divided profits and occasional serious delays in delivery or defective castings furnished, for which they are accountable but not directly responsible.

"3. Manufacturers who need a few thousand tons of steel castings a year to put into the product of their own factory, but whose requirements are not large enough to warrant running continuously an open-hearth furnace of economical size. In the United States there are several concerns of this class, who have put in a side-blow converter plant.

"4. Open-hearth foundries which have occasional desirable orders for castings not suitable to open-hearth steel, on acount of being small or with thin sections, or with special chemical requirements. Thus a good customer may desire small bevel gears in large quantities, with high carbon to give good wear, or a locomotive works will often send out orders for several large castings together with a number of small ones. To get the desirable work the foundry may take the order and sublet the small work to another foundry at an actual loss to itself, relying on the larger work to make this up and also furnish profit for both parties.

"5. Also in general any foundry expecting fluctuating orders.

"It is better to have a small amount of metal coming to the foundry at frequent intervals:

"1. Because of a greater possible variation in chemical composition and consequent elasticity in fulfilling different physical requirements. Each unit of steel must be uniform in chemical composition and with large units it is difficult to fit them exactly to the different orders. It is impossible to divide units into small units, unless the steel is extremely hot, because the steel loses too much heat by radiation on standing or during repouring. This is an advantage of constantly increasing importance with the more extended use of steel castings in many industries. Alloy-steel castings, hard steel for wearing purposes, soft steel for ordinary castings, or extra soft for electrical purposes, are often called for, perhaps all on the same order.

"2. Because of the better arrangement of the work, since the pouring may be done by one gang who do nothing else, and become very expert at it in practice, while the rest of the shop is not interrupted at all in its regular work. When the pouring is done in large units it takes a number of men to do it and the whole shop is more or less interrupted for twenty or thirty minutes, three or more times a day, depending on whether the foundry is served by one or more furnaces. The amount of time lost in this way must be weighed against the wages of the extra men needed for continuous pouring and each shop must strike its own balance. Again, the crane or the apparatus for pouring must be more powerful when pouring in large units. When pouring in small units and continuously, this apparatus is never available for anything but pouring and an extra one must therefore be kept for the purpose.

"3. Because of the smaller floor space required for setting molds. The work of molding, setting, pouring and knocking out can go

on continuously in a small space and this a valuable economy in a foundry."

Having thus mentioned several bright sides of the side-blown steel process, I wish to say a few words about

Disadvantages.

It is well known that several manufacturers have abandoned their plant for making side-blown steel. The reasons generally attributed are waste of metal and of refractory materials. The normal difference of weight between the pig iron charged in the cupola and steel obtained at the mouth of the converters is 14% to 17%. How much of this stands as actual waste in the converter is somewhat uncertain because the melted pig iron is generally not weighed. But the loss in the cupola alone should not be above 5% and the total amount of silicon, carbon and manganese about 6%. The remaining 3% to 6% is of course not much. But at several works the loss of iron amounts to considerably more than 17% and even runs up to 30% continuously for months. It is admitted that more iron is burnt inside the surface-blown converters than in a bottom-blown, which is also evidenced by a greater amount of oxide of iron thrown out in the shape of red smoke. There is also a complaint that the side-blown converter spits more slag and steel than the bottom-blown. This, however, looks doubtful to me and the side-blow charges I have witnessed have been as a general thing absolutely clean. Excessive burning and throwing out of metal depends to a great extent on defective management; for instance, too cold iron, wrong composition of the pig iron; faulty regulation of the blast, burnt-out lining and tuyeres whereby the blast is not delivered in straight well-defined lines, or wrong position of the converter. Altogether it requires more skilled labor and attention, to manage a side-blow than a bottom-blow.

The greater waste of the lining depends on the higher heat, combined with a larger amount of oxidized iron which saturates itself with more silica than resulting from the burning of the silicon in the pig metal. This was of course aggravated in the previous constructions where the side-blow was delivered under the surface, thus giving a rotary motion to the steel. It remains to find a durable lining for side-blow converters. The bottom is more rapidly worn than the sides and recently constructed improved converters therefore have detachable bottoms. By bottom is meant the whole lower part including the tuyeres. This lasts 10 to 20 heats if it is kept in good order, and the superstructure lasts about 40 to 50 heats. By constant patching the lining in the Tropenas converter can last about 150 heats. In bottom-blown converters the bottom lasts about 25 heats and the upper lining 200 to 300. The economy of refractory material of course depends also greatly on the quantity to be renewed. This is larger if the division line between the top and bottom is above than below the trunnions. In the last named case the bottom part can also be more easily changed. In the bottom-blown converters the interchangeable part constitutes of course a much smaller percentage of the whole, as no part of the sides is attached to the bottom.

Waste of Metal After the Blow.

The waste of metal after the steel has left the converter is caused by three circumstances:

Spattering during the pouring which amounts to 1% to 2%, depending on the size of the castings.

Skulls in ladles proportionately to the heat of the metal.

Sinkheads and gates which naturally constitute a larger percentage the smaller the castings are. These can of course be made thinner the hotter and quieter the metal is. The work in getting off the sinkheads is a considerable item in the making of small castings. They cannot be knocked off with a hammer but have to be either sawed off close to the casting or chipped off and the root ground, which is generally more work. This is a drawback in small steel castings, by whatever process. The question what to do with all the steel scrap, whereof the sinkheads and gates under normal circumstances constitute the largest proportion, should be carefully considered. When the converter plant is isolated the steel scrap will have to go into the cupola and the amount thus to be consumed will generally have to be limited to 25%. The steel requires more fuel to melt and higher temperature. Besides the pig iron is thereby diluted and the silicon lowered which is the expensive fuel on which the heat in the converter to a great extent depends. Then there is always danger of delivering the pig metal too cold to the converter if too much steel scrap is melted. The amount of scrap from small steel castings can easily exceed 25%, and then scrap heap in front of the cupola will constantly increase. The excess will have to be disposed of at a loss to open-hearth

steel makers. The side-blown converter therefore works to best advantage in conjunction with an open-hearth furnace, which can consume the scrap with expenditure only of coal and labor, leaving the cupola undisturbed for melting the pig iron.

Construction.

I will here only refer to those converters which are in practical use. As far as I have been able to ascertain, side-blown steel is only made in America by the following three processes:

The Tropenas converter has a double row of tuyeres, the upper one being intended to burn the carbon oxide inside the converter, thus increasing the heat. The tuyeres are either parallel or converging towards a point beyond the center of the converter. The upper or combustion tuyeres are rectangular or oval with the large axis horizontal. Both rows of tuyeres pass through a projecting ledge in the lining of larger diameter than the converter itself and are intended to check the rotation of the steel. The distance between the rows is 4 to 7 inches. The diameter of the lower tuyeres is 1.25 to 2 inches according to the size of the charge. One object of the tuyeres being laid in such a concave ledge is that in case of the metal running into the outer longer ones, warning will thereby be given before all are stopped up. The lower part of the converter is conical for one ton and cylindrical for larger sizes. The bottom is fixed and the relining is done through a manhole. As above mentioned it is thus necessary for continuous operation to have three converters, one for repair, one to be dried and one in operation.

The long tuyere modification as built by Mr. B. Stoughton has only one row of parallel tuyeres 1½ to 2 inches placed in the flat side of the converter. The constructor has the view that a better result can be obtained by burning the carbonic oxide close to the surface of the metal bath and 4 inches to 7 inches above, as in the Tropenas construction and that this can be accomplished by only one row of tuyeres. He also found that the second upper row, unless very carefully watched, is liable to furnish excess of air representing loss of blowing power and loss of heat by cooling. The tuyeres are made by iron pipes rammed into the lining, the ends projecting about 6 inches into the wind box. The distance between the tuyeres and the mouth is increased about 50% over that of Tropenas construction in order to reduce the loss by spitting. The lowest part is detachable whereby only one, at most two, converters are needed as the bottoms give out earlier than the superstructure. Both of the said converters revolve in the ordinary way on trunnions through which the blast is delivered.

The third of the side-blow converter type in active operation is the Evans-Wills, delivering the blast through flexible pipes and having the turning center below the bottom of the converter. The lower part with the wind box attached is removable from the superstructure and placed on wheels. After the blow it is rolled away and used as a ladle for casting in different places. A hole in the upper edge serves to rake out part of the slag.

In all side and surface-blown converters the diameter and the depth under the tuyeres should not exceed certain limits if the action is to be thorough. I lay special stress on this because there are parties here who have spent lots of money and suffered agony of mind before they found out that the only trouble was too great depth of the metal bath. Makers of small castings have generally stopped at 2-ton converters, but larger ones are contemplated. As it is not safe to increase the depth or diameter, the only dimension which could be extended is the width, making the cross sections elliptical and giving the converter room for more tuyeres.

The cupola melting the pig iron is either on the ground, when the liquid metal has to be lifted by an elevator to the mouth of the converter, or the metal may run down from the cupola to reach the converter. In the former case the advantage is gained that the pig iron can be weighed and sample taken to find out whether the pig metal after being melted is suitable for the blow. But on the other hand one more elevator has to be furnished which is more expensive than to elevate the raw materials for the cupola a few feet higher, and the pig metal loses some heat by being poured in a ladle.

As the blast pressure is only 4 lb. per sq. inch and it is the question of volume and not pressure an ordinary blower with ordinary twin impellers can be used for cupola and converter alike. The power required is about 1-10 of that for bottom-blown converters.

Operation.

As it is important that the blast should be delivered in an acute angle just above the surface of the metal the quantity poured into the

converter will have to be regulated accurately (in a bottom-blown converter, of course, no attention needs to be paid to this). After the filling the converter has to be placed just in the right angle by turning the wheel of the gear, opening the back of the wind box and looking through the tuyeres. The blast ought to strike the metal about half way across and be delivered in well-directed parallel currents. Irregularity in that respect will cause more spitting. During the first period, 25 to 30 percent of the whole, only sparks and red smoke appear, the last named from oxide of iron showing up to a greater extent than in a bottom-blown converter. The liquid metal is not at rest but has the rotary motion of a wave and the action can therefore only extend to a certain depth. As in all converting processes the basic silicate of iron first formed acts on the carbon, thereby forming carbonic oxide, which helps to keep the metal in motion, although of course the agitation is much less than in converters where the air comes in under the surface of the metal. As the flame becomes white and strong during the boiling, the blast pressure is reduced to 3 or 3½ lb. and the converter is tilted slightly backward. During this boiling period, about one-third of the blow, there is no red smoke. Then the flame drops. Whenever the flame is short, red smoke appears. The spitting is worst toward the end of the boiling period. Then the flame lengthens a second time and becomes clear and white, until the final drop at the end of the blow, during which last period full blast is turned on. If spitting occurs during the last period, there is something wrong in the lining, the tuyeres or the position of the converter. The blow of two tons lasts about 20 minutes. Analyses of the escaping gases show about the following proportions.

	CO	CO_2
4 minutes from beginning.....	0.	8.2
10 min. from beginning boiling..	0.30	24.3
12 min. from beginning boiling..	0.40	8.8
17 min. from beginning shortened flame	10.70	12.
21 min. beginning end.		

Corresponding analyses of gases from a bottom blown converter have appeared as follows:

	CO	CO_2
4 minutes from beginning.....	3.95	8.59
10 minutes from beginning.....	19.59	3.58
14 minutes from beginning.....	31.11	1.34
18 minutes from beginning, end.		

It will thus be seen that in the side-blow the carbonic oxide is well oxidized during the boiling; after that it is increasing until the end of the blow. At the late period when about 10 percent each of carbonic oxide and carbonic acid appear, there is also about 7 percent free oxygen. This depends on the inaction of the carbonic acid during the excessive heat and of course no amount of extra air would then burn the carbonic oxide. This also accounts for the apparent anomaly that the flame at the end of the blow is at least just as long as in a bottom-blown converter for the same carbon. The analyses of gases from the last named show a steady increasing amount of carbonic oxide. These circumstances make it more difficult to determine the carbon by the appearance of the flame in a side-blow converter. But this is simplified because as far as I know the bulk of the side-blown steel has either 0.25% or 0.10% carbon. Although the economy of heat in the converters has been several times exposed I think it would be of interest in connection with this matter to repeat some of the figures.

The units of heat (that is the multiples of heat needed to raise 1 lb. of water one degree) developed by the combustion are as follows:

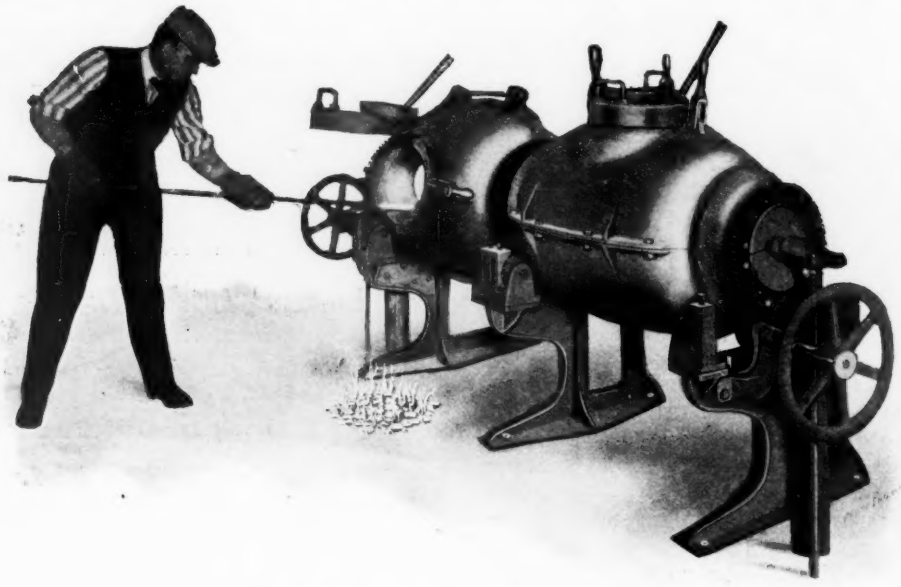
Hydrogen	34,462
Silicon	7,830
Iron	1,650
Carbon to carbon monoxide	2,474
Carbon monoxide to carbonic oxide....	2,403
Carbon to carbonic acid.....	8,080

The silicon therefore gives a considerable amount of heat which stays in the metal, the product being liquid. The iron gives some heat in burning but this to a great extent is taken back when the iron oxide is dissolved in contact with the carbon. Some heat must also be developed by the oxidation of manganese and by the combination of the silica with the oxides, although I have never seen an estimate of the last named. The oxidation of the carbon to carbon monoxide in the metal bath gives 2,474 units of heat per unit of carbon. But only part of this is given to the steel because the product of combustion takes flight and carries away the bulk of the heat from that source. By burning the carbonic monoxide outside the metal bath and inside the converter additional heat is obtained to the extent of 2,403 units of heat per unit of carbonic monoxide. But inasmuch as one unit of carbon corresponds to 7-3 units of carbonic monoxide the additional heat thus gained referred to the unit of carbon in the pig iron will be $7\text{-}3 \times 2{,}403 = 5{,}607$ units. This is quite a considerable increase, but only a limited amount of this is imparted to the steel, the bulk of the hot gases instantly leaving the converter. The re-

sult would be better if it were possible to construct a converter in such a way that the gas currents above the metal bath would not be so rapid. Although the metal is very hot and liquid it is well to add some ferro-manganese to be sure of absolutely quiet steel before casting. The slag must, of course, be removed more carefully in casting over lip. In the Evans-Wills converter it is raked out through a side hole in the detachable underpart. In some operations with ordinary side-blow converters sand is shoveled in through the mouth of the turned down converter after the blow, thus forming a tough slag as a cover, which does not follow the steel. A dam with fire bricks is then formed and the steel is tapped through the lowest part of the mouth.

ROCKWELL ROTARY MELTING FURNACE.

This is an entirely new type of metal melting furnace. One of the principal features is the utilization of the heat from the spent gases of combustion. This is accomplished by means of the two chambers, which are independent but located end to end and communicate with each other through the necks. One of the chambers is always in the act of melting, the other receiving the spent gases which give up their heat into the fresh charge of metal in this latter chamber. As soon as one melt is poured and the chamber recharged the fire is reversed and in this manner the melting is practically continuous. It is quite reasonable that it should result in saving fuel and time and protect the metal. While the operation as a whole is rapid it will be seen that the metal is heated gradually, and that the fuel never enters a cold chamber.



ROCKWELL ROTARY MELTING FURNACE, SKIMMING.

Another feature is the absence of crucibles, nor are any tiles or fire brick used in the lining. The lining is an inexpensive material rammed into the furnace shell in bulk and burned hard and refractory in place. The furnace is noteworthy also for its ability to melt two different metals at the same time. While the normal operation is that of melt and reverse it is also entirely practicable to operate both burners and melt in both chambers at the same time, and where different mixtures are

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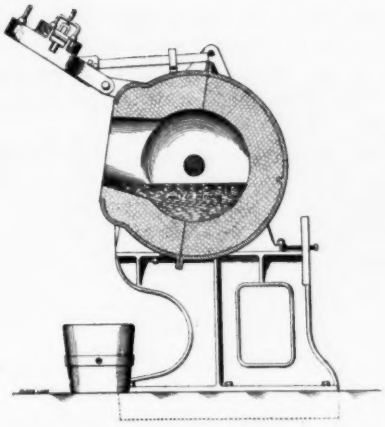
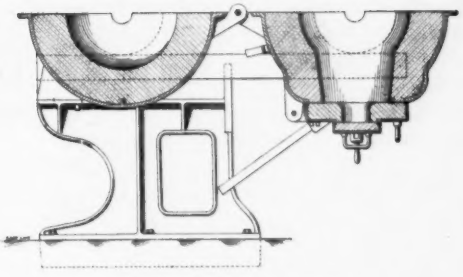
Concerning the plant for the manufacture of steel castings at Birmingham, Ala., in which J. R. McWane, of Lynchburg, Va., is actively interested, we are informed that W. T. Adams, of Corinth, Miss., will also invest in the new company and that Birmingham citizens will also probably connect with it. As yet the capital stock is not determined, and the company has not been incorporated. Negotiations are now pending for a building now occupied by another concern. The failure of these negotiations would mean the erection of suitable buildings on land acquired for that purpose.



SECTIONAL VIEW OF FURNACE, POURING POSITION.



SECTION OF FURNACE, OPENED FOR RELINING.

required this would be very convenient. The one kind of metal could be melted at the same time in both chambers if an unusually large casting was wanted.

Other features are, large output as to floor space required, general convenience and cleanliness and no complicated parts or expensive repairs. Oil or gas is used as fuel, and the air for combustion is supplied from an ordinary fan.

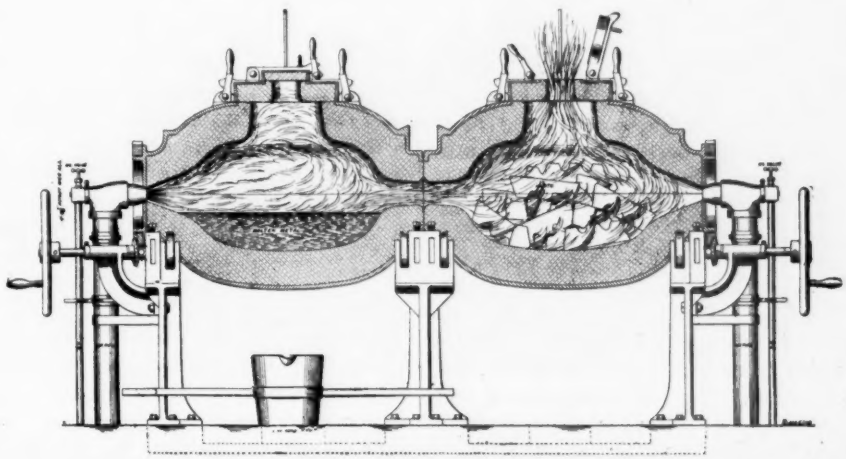
The furnace is sold in four standard sizes ranging in capacity from 350 to 3,000 pounds each chamber. It is manufactured by the Rockwell Engineering Co., of 26 Cortlandt street, New York.

The Fayette Foundry Co., Uniontown, Pa., has been incorporated with a capital of $15,000.

KISH, SON OF CARBON.

"Kish," son of Carbon, is a degenerate son of a worthy sire. Scientific folks call him by another name and try to make him appear respectable. People who make castings out of iron and a few other things mixed with it know better than to call him anything but what he is; just "Kish," which means dirt. There is no way to reform him; he can only be prevented. If he once makes his appearance it is all over with the casting and all over with the peace of mind of the foundryman.

Everybody knows that pure iron is a laboratory product and only good to put on the shelf to be looked at as a curiosity. Steel is essentially a combination of iron and carbon, so is wrought iron, so is cast iron and so is pig iron, but the latter contains more of the



SECTION SHOWING FURNACE IN ACTION.

other elements than does the steel, which is the nearest to pure iron, of anything. In fact, iron is not worth a cent a ton for practical purposes without carbon, but carbon, when it gets out of place, becomes "Kish." Therefore the foundryman's problem is how to keep the carbon where it belongs and not only *where* it belongs but *as* it belongs.

Carbon is held in pig iron and cast iron in two conditions: in solution or combination like sugar in a custard pie, and in mechanical mixture like sawdust in a loaf of bread. In the former case it is known as combined carbon, in the latter as free or graphitic carbon, which it the father of "Kish."

It is generally said that silicon makes iron soft and sulphur makes iron hard. Quite the reverse. Silicon makes iron hard and brittle, sulphur makes iron soft and weak.

When iron containing carbon is in a melted state the carbon is all in solution and is combined carbon. As the iron cools and hardens some of the carbon remains combined and some of it separates in more or less minute particles and is held in the pores of the iron as graphitic carbon or gathers into larger pockets in the interior or on the surface of the casting and becomes "Kish," our friend the enemy.

While silicon, acting on iron alone, makes it hard, acting on iron and carbon it causes the carbon to take the graphitic form and the graphitic carbon makes the iron soft and if there is enough carbon and enough silicon out comes "Kish" and trouble.

While sulphur makes iron soft, it causes carbon to combine with it, which makes it hard, and if there is too much sulphur for the silicon the iron will be too hard and the other kind of trouble will be there.

Of course the ideal condition would be to have just the right amount of carbon, silicon, sulphur, phosphorus and manganese in all pig iron, but this condition is only brought about with difficulty and expense. We have to take the iron as it comes and make the best possible out of it.

Sulphur is easy to dispose of. Manganese with limestone or oyster shells in the cupola will do it, but won't touch silicon. If iron is high in silicon and high in sulphur the two elements will, to a certain extent, neutralize one another in their effect on the carbon, but if the sulphur is removed by manganese and the iron is high in carbon the silicon is likely to remain too high, graphitic carbon too high and "Kish" will be the result. A high manganese iron used with a high silicon, high sulphur iron should be lower in silicon than if the manganese were not present. If the sulphur is reduced in quantity the silicon must come down with it, and the reverse.

The beginner in making up mixtures for the cupola should look more to the relative proportions of silicon and sulphur than to the total percentage of either, and when the proportion is right, be the totals high or low, it will do just as much harm to reduce the sulphur as to reduce the silicon. They must go up or down together.

If "Kishy" irons are on hand and must be used, add some good, old-fashioned gray forge iron, low in silicon and higher in sulphur than ordinary foundry irons. The carbon will remain *where* it belongs and *as* it belongs and "Kish" will not appear. A little experience will show just how much to use.

There are other ways of producing the same result, but they are all more expensive except when scrap iron is relatively low in price, and scrap is variable and uncertain.

Above all things, the beginner should bear in mind that silicon and sulphur are to be considered with reference to their influence on the iron *by means of the carbon only*. Their effect on iron without carbon is a problem that the foundryman need not bother himself about.—[Publication by Rogers, Brown & Co.

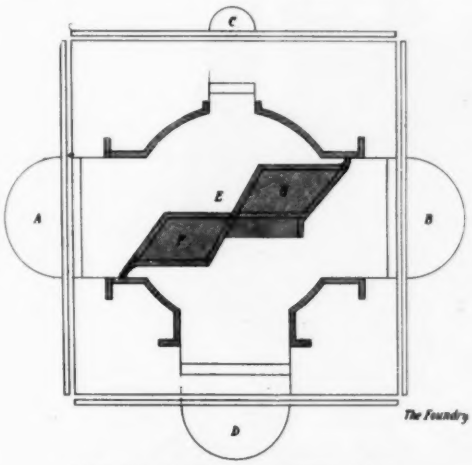
CORE FOR THREE-FOOT RELIEF VALVE.

BY HARRY WILLIS, CHRISTCHURCH, NEW ZEALAND.

Among an order for a quantity of steam pipes and fittings there was one for a 3-foot 4-way ball valve with valve seat. As the size was an unusual one we did not have either the pattern or core box, and as there was only one to make, it was decided to try to overcome the difficulty without the assistance of either. The core was swept up in halves on a board. The accompanying figure illustrates the process. For clearness the section of the middle valve casing has been drawn on the board. The part pattern for forming the valve seat and division is shown in place and this conceals the section of the valve seat. The four views *A*, *B*, *C* and *D*, show the ends of the prints. These were formed with properly shaped sweeps. The division in the center of the valve was made in two pieces divided along the center at the letter *E*. The pieces *F* and *G* were drawn out through the bottom of the board. The half cores were dried on the board

on which they were swept up. When dried and black-washed an extra thickness of loam was swept on each half and dried. The halves of the core were then joined together and wooden patterns for the flanges fitted upon the core prints. The core was then used as a pattern to make the mold. The mold was made in green sand in the ordinary way. When the mold was finished the extra thickness of loam was taken off the core and the core replaced in the mold. The job was successfully cast.

I do not suggest for one moment that the above method could be adopted as a general



CORE FOR TAREE-FOOT RELIEF VALVE.

principle, but I think it is as simple and as cheap as any that could be adopted under similar circumstances. The pattern-making in connection with this job only amounted to about four hours of one man, whereas if a core box or even a half core box had been made, it would have reduced the profit of the job to a minimum.

DRYING CORES WITH STEAM.

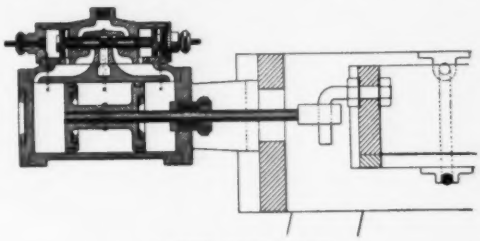
BY F. B. CHAMBERS.

Some time ago in *The Foundry* there appeared a question as to the experience different molders had had in drying cores and molds by steam heat. I have had some little experience in this line, but must say with very poor results. In small cores it may do in cases where there is no large flow of metal. Steam dries out cores but does not bake them. There is no crust on the steam dried cores, therefore the surface is soft and crumbles easily. Cores, as well as molds, must be baked the same as bread if they are to have a hard surface. Did any one ever hear of a baker making bread or cakes by steam? Hot air bakes and forms a crust on cores and molds while steam simply draws the moisture out from them causing them to become soft and crumbly as though left exposed to the atmosphere. Fire heat from charcoal or coke is the only thing to dry cores, dry sand, or skin dried molds with any success so far as my experience goes.

In drying large molds or cores I have always found it best to put a layer of coke in the dry sand molds or in the center of large cores and to connect this layer of coke with the surface by vent holes. The surface of the mold or core always dries first and forms a hard crust so that the rest of the moisture must be driven out through the coke and vent holes. In the case of small cores vents through the center are all that are necessary. Steam draws all the moisture from a core or mold out through the surface, and hence makes the core or mold soft at the surface. The larger the core or mold, as a general rule, the harder its surface should be, hence the fire dried cores and molds are always best where they must resist a considerable flow and pressure of metal.

A New Sand Sifter.

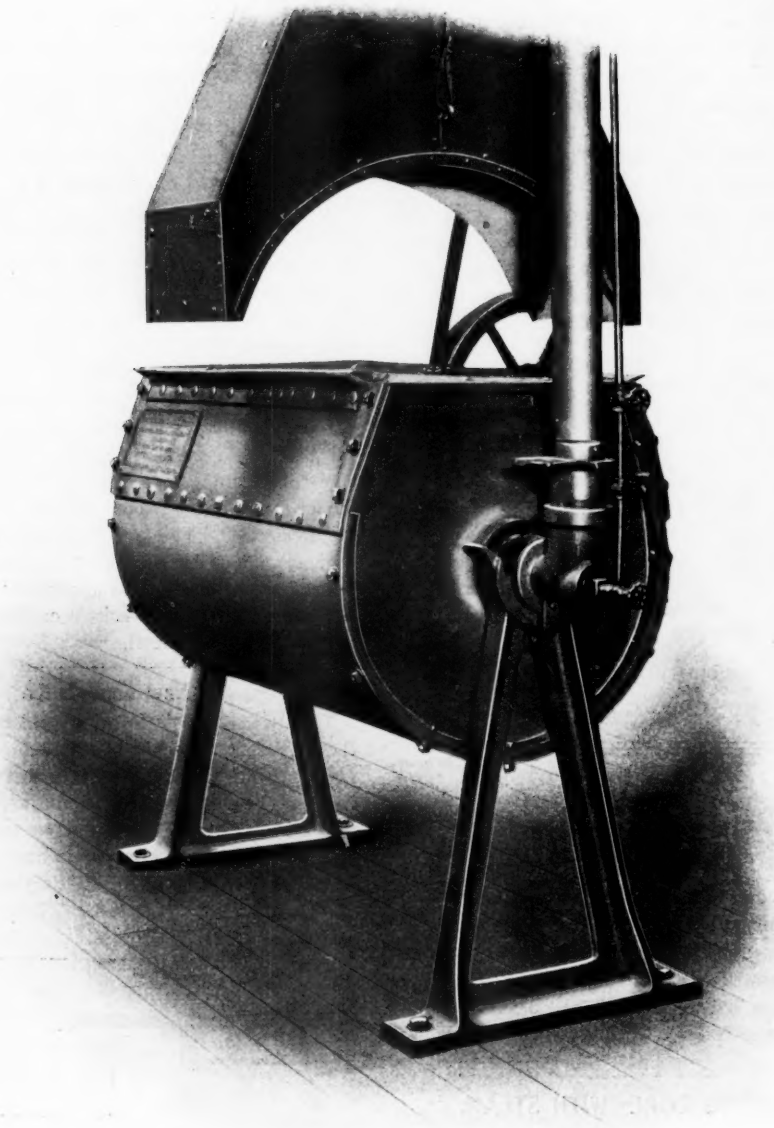
The Battle Creek Interior Finish Co., Ltd., Battle Creek, Mich., has developed a new sand sifting device for its own use which it is now putting on the market. It consists of an ordinary rectangular screen hung in a stationary frame work so it can be made to shake backward and forward by means of a



A NEW SAND SIFTER.

piston operating in a cylinder attached to one end of the frame, as shown in the accompanying cross-section. The apparatus can be operated either by air or steam using a pressure of from 20 pounds up. The air or steam pressure is regulated by the throttle according to the work the machine is doing.

The firm of Wunderlich & Motzer, brass and iron founders, Lebanon, Pa., has been dissolved, and the business will be carried on by Fred Wunderlich.



THE ORBISON OSCILLATING MELTING FURNACE.

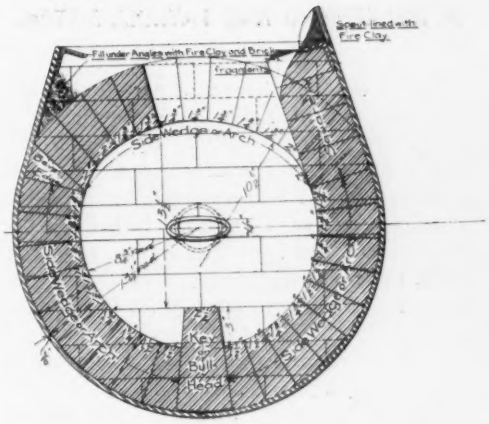
THE ORBISON MELTING FURNACE.

Most of the fuel oil or gas melting furnaces are open to the objection frequently raised to the reverberatory furnace, and that is, that the heat must enter the metal bath from above, so that to obtain a good heat of metal through the bath it is practically necessary to overheat the surface of the metal. Then, in some of these furnaces it has been a difficult matter to thoroughly mix the metals. To overcome the difficulty of burning out the spelter and oxidizing the charge by long exposure to the heat some makers of melting furnaces have resorted to higher oil and gas pressures, giving a blow pipe effect, intended to increase rate of melting and decrease the length of time the metal is exposed to the heat of the furnace In the type of furnace under consideration a

different course has been pursued. The air pressure is kept as low as possible, being from 5 to 6 ounces. When refined oil is used, a pressure of 8 pounds is sufficient. If crude oil is used this pressure has to be increased to as much as 20 pounds in some cases.

In order to insure a thorough mixing of the metal and an equal distribution of the heat throughout the mass, provision is made for oscillating the furnace while the metal is being heated. The furnace proper consists of a cylindrical shell with cast iron heads. This shell is supported on suitable trunnions and oscillated by means of a pin attached to one head. The furnace is charged through an opening in the side near one end, as in the case of most of the furnaces of this type. At the bottom of the furnace a row of key or bull head bricks are placed in the lining and allowed to project into the furnace two or three inches. As the furnace oscillates, the metal flows back and forth over this rib, thus insuring thorough mixing. The furnace is not started to oscillate until the metal is all or nearly all melted.

The company has recently made some tests comparing the strength of metal melted in its furnace and in crucibles. These tests were made from its ordinary hard brass used for regular machinery castings. On four test bars of metal cast from crucibles the minimum tensile strength was 20,260 lb. and the maximum tensile strength 26,350 lb. The minimum elongation was 2.5 percent and the minimum reduction in area 3.2 percent; the maximum elongation was 9.5 and the reduction in area 8.3. On four tests made from

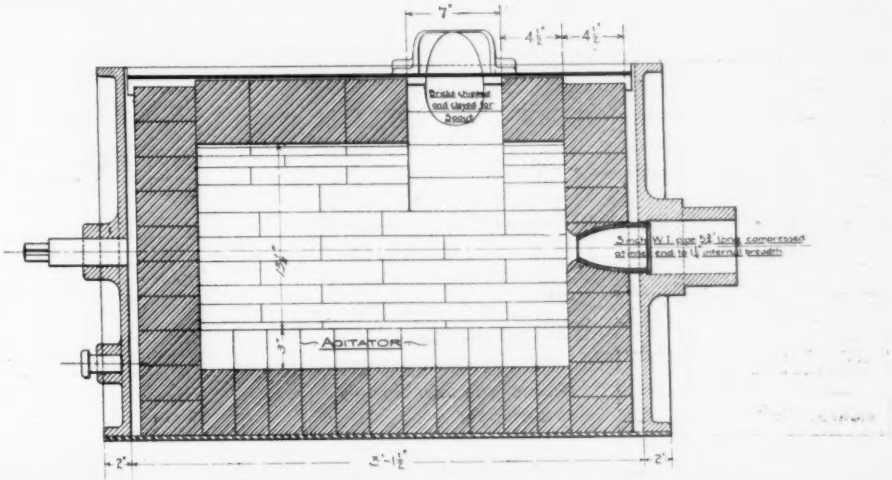


CROSS SECTION.

metal melted in the furnace using exactly the same mixture the results were as follows: Minimum tensile strength 30,230 lb. and the maximum tensile strength 32,340 lb.; the minimum elongation was 12.5 percent and the minimum reduction in area 8.8 percent; the maximum elongation was 15.5 percent and the maximum reduction in area 14.3 percent. In a series of tests made demonstrating the time necessary for melting, the full capacity of the furnace was melted in 25 minutes, and by under charging the furnace a heat was taken off in 15 minutes.

The company also claims that in tests made an average of loss of less than 2 percent of the metal charged was experienced, and that the oil consumed was less than 2 gal. per 100 lb. of metal.

The furnace is manufactured by W. T. Garratt & Co., San Francisco, Cal.



LONGITUDINAL SECTION OF ORBISON FURNACE.

A TIMEKEEPING AND PAYROLL SYSTEM.

BY R. W. MACDOWELL.

One of the most important parts of a well-regulated system of foundry accounting is a simple yet complete method of keeping the time of the workmen in all departments. Such a system must of course provide for both day work and piece work, and must be both simple and accurate. An inaccurate system, or one in which there is much liability of clerical errors is a continual source of trouble, both in foundry and office; as constant arguments and discussions between workmen and timekeepers, delays on paydays and irregularities in the cost system, are its natural results. A way should be provided for comparing the timekeeper's calculation of each man's time with the man's own figures, a few days before payday, especially in the piecework departments, in order to avoid disputes and facilitate quick pays. The method we are about to present takes care of this point in a very satisfactory manner.

There have been a great many different ways of timekeeping employed at different times and places, a large number of which were extremely incomplete and unsatisfactory, providing for nothing whatever but the workman's time, and even this in a very slovenly and inaccurate manner. One method was for the timekeeper to go through the shop morning and evening with a sort of time book in which he marked down the number of workmen present, indicating a man's presence by a cross

KEYSTONE FOUNDRY CO.
UNIONTOWN, PA.

PAY JUN 27 1903 190

No. 16

NAME Lemon

12 DAYS @	2 00	24	00
TOTAL CREDITS.			
DEDUCTIONS			
RENT			
ORDERS		10	00
BOARD			
AMOUNT PAYABLE		14	00

DATE	A. M. IN	A. M. OUT	P. M. IN	P. M. OUT	
MONDAY	6 30/31			5 15/17	10
TUESDAY	6 38/39			4 45/46	10
WEDN	6 24/25			5 42/43	10
THURS	6 24/25			5 1/2	10
FRIDAY	6 38/39			4 56/57	10
SATUR	6 26/27			4 56/57	10
SUNDAY					
MONDAY	6 45/46			5 5/6	10
TUESDAY	6 25/26			5 34/35	10
WEDN	6 41/42			5 23/24	10
THURS	6 58/56			5 15/16	10
FRIDAY	6 38/39			5 12/13	10
SATUR	6 39/40			5 40/41	10
SUNDAY					

Received from Keystone Foundry Co., in full of all demands as above the sum of 14 00 DOLLARS

SIGNED E Lemon

The Foundry

FORM 1.

This Side Out

16

No.

OVER TIME

The person in whose name this account is issued by receipting for balance and surrendering this certificate on payment acknowledges its correctness.

DAY	IN	OUT	IN	OUT	
MONDAY	6 35/36				
TUESDAY					
WEDN					
THURS					
FRIDAY					
SATUR					
SUNDAY					
MONDAY					
TUESDAY					
WEDN					
THURS					
FRIDAY					
SATUR					
SUNDAY					

Not negotiable or transferable, and payable only on surrender.

The Foundry

KEYSTONE FOUNDRY CO.
UNIONTOWN, PA.

PAY JUN 27 1903 190

No. 88

NAME Knight

6 DAYS @		13	50
Pc. Wk		16	28
TOTAL CREDITS.		29	78
DEDUCTIONS			
RENT			
ORDERS		5	00
BOARD			
AMOUNT PAYABLE		24	78

DATE	A. M. IN	A. M. OUT	P. M. IN	P. M. OUT	
MONDAY	6 44/45			5 16/17	10
TUESDAY	6 45/46			4 47/48	10
WEDN	6 50/51			5 42/43	10
THURS	6 52/53			5 4/5	10
FRIDAY	6 42/43			5 52/53	10
SATUR	6 43/44			4 55/56	10
SUNDAY					
MONDAY	6 35/36			5 8/9	278
TUESDAY	6 30/31			5 24/25	265
WEDN	6 43/44			5 20/21	246
THURS				5 15/16	270
FRIDAY	6 51/52			5 12/13	310
SATUR	6 44/45			5 33/34	310
SUNDAY					

Received from Keystone Foundry Co., in full of all demands as above the sum of 24 — DOLLARS.

SIGNED F. Knight

The Foundry

FORM 5.

PAY ROLL FOR TWO WEEKS ENDING June 27 **1903**

DEPARTMENT

No	NAMES	M.	T.	W.	T.	F.	S.	S.	M.	T.	W.	T.	F.	S.	S.	Hours	Rate	Piece Work	Day Work	Discount	Total	DISTRIBUTION BY ACCOUNTS: Patterns	Improvement	Tools	Machinery	Equipment
16	Lennon	10	10	10	10	10	10	10	10	10	10	10	10	10	10	120	2.0		240 0	10 00	140 0					
17	Clymer	10		10	10	10	10	5	10	10	10	10	10	10	10	105	15		157 5		157 5					
87	Barnes			10	10	10					Guest					30	2.0		60 0		60 0					
88	Knight			10	10	10	10	10	3½	3½	3½	3½	3½			60	3.25		195 0	5 00	347 6					

The Foundry

FORM 2.

placed opposite his name. This method had many disadvantages, among which were the confusion in attempting to list any large number of men in this manner, the liability to miss a man at work or to mark an absent man as present, and the chances to mix up the time of men whose names were written close together. Another method was to have each man turn in a card each evening, stating the number of hours he had worked, or in the piecework departments, a description of the work he had done. These cards were taken up in the morning following and O. K.'d by the foremen of the different departments. This was an improvement, as it afforded an opportunity for a more acurate pay roll, and in addition, the cards were in the office as evidence in case of a dispute, but many chances were given for errors through the failure of many of the workmen to turn in cards, and as a consequence, shortages on paydays would result, causing considerable trouble to adjust. A better plan was the check system, in which each man was provided with a brass check with his number stamped on it; these checks being turned into the timekeeper each morning as the men came to work, the timekeeper arranging them on the check-board after entering them in his time-book. Thus accurate record could be kept of the time of every workman, as the exact time could be noted when he came to work and when he left. This method, or modification of it is still in use in a great many factories, and in many lines of work is entirely satisfactory, and is a great improvement over the methods previously described.

In the system we advocate, every man practically keeps his own time, by means of a Rochester time recorder. This machine is placed on the wall near the entrance to the shop with a rack on each side for the time cards (Form 1). As a workman enters the shop he takes his card from the first rack, goes to the clock and registers, and drops his card in the second rack, in the slot bearing his number. This shows the exact time he went to work in the morning. The slots in the racks bear large, plain numbers, so it is an easy matter for the workman to pick out his card without delay, especially as he rapidly becomes accustomed to its location in the rack. All workmen are provided with the clock cards whether they work day or piece work, a card being used two weeks, which is the length of time paid up at each pay, and is replaced by another one bearing the same number as soon as this time is up. When all the men have

DAILY REPORT OF CASTINGS,

June 15 1903

NAME		MARK	ARTICLE	WT. EACH	NO. CAST	DISCT.	NO. GOOD	WT. CAST	WT. DISCT.	WT. GOOD
Knight	88	V-2751	Journal Box	130	28	3	25	3640	390	3250
Warman	89	V-2751	" "	"	20	0	20	2600		2600
Gardner	93	V-2751	" "	"	24	4	20	2600	520	2600
Maddas	125	V 250	Ratchet Wheels	4	125	✓	125	500		500
Giles	126	V 3023	Pawls	2	230	✓	229	460	2	458
								25627	1049	24578

The Foundry

PRODUCTION SHEET, FORM 4.

come to work in the morning the second card rack shows who are at work, while the first rack shows who are absent. This can be seen at a glance, and is a great convenience at times. If a man wishes to leave the shop during the day he obtains a pass-out check from the foreman, and registers his time of leaving and returning, on the two inside columns on the face of his card. In the evening at quitting time the same process is gone through with; each man registering the time of his departure, and putting his card back in the first rack according to number. Each man thus has his exact time registered on the card for that day. In this way, every man's time is complete on one card, and is absolutely accurate. In a larger plant than the one from which this system was taken, more clocks would be needed, the number varying with the size of the plant, the number of different departments, and the number of men at work in each department. When more than one clock is used it is a good plan to have the cards belonging to the different clocks of different colors, and to have them marked "Clock 1," "Clock 2," "Dept. A," "Dept. B," or whatever designation is the most convenient. This will prevent confusion, and will greatly simplify matters for the timekeeper.

The records made on the cards are so complete that it is really not necessary to enter the time in a book, but in the present case a book record is preferable, so Time Book (Form 2) is used. This book provides for both day work and piece work, with all deductions, and is also arranged to take care of the labor distribution to various accounts, if it is

desirable to charge these accounts direct from the pay-roll, instead of from the shop orders. It depends largely on the nature of the business as to which method of charging off time is preferable. The names in the book may be arranged to suit the convenience of the timekeeper, either by departments, numbers, or any other arrangement that may be found desirable. If the time is to be entered in the book each day, as it is in the present instance, the numerical arrangement is the most convenient, as the cards can be taken from the rack as they come, in regular numerical order, and entered in the book by the timekeeper without any delay in searching for names. The cards can then be replaced in the rack without rearranging, and considerable time can thus be saved.

In the shop from which this system is taken, the only men working piece work are the molders who are required to turn in a card (Form 3) each day, showing what work they have put up and poured that day. From these cards

TIME CARD

Keystone Foundry Company.

Name Knight 87

Date June 15 1903

HOURS KIND OF WORK

28 Journal Boxes

HAND IN EVERY EVENING The Foundry

FORM 3.

the production sheet (Form 4) is made up. This is gotten out in triplicate—one copy for the office, one for the stockkeeper, and one for the information of the molders—and is a very important record, as from it the stock records, the amounts due the molders, and the percentages, are all obtained. When the day's work comes out of the cleaning room it is counted by two different clerks to insure correctness, and the number of good and rejected castings with the weight of each and the total weight entered on the sheet.

When this is done, one copy is filled out giving the molder's percentage of loss and the total percentage, and is then hung up in the foundry. This gives the men a chance to figure up their wages each day and avoids many disputes on payday, as all the differences can be adjusted at the time the sheet is hung out. The other copy goes to the stock keeper in order that the day's production can be entered on his records, while the original is taken to the timekeeper, who goes over the sheet, figuring each man's amount as he comes to it and entering these amounts in lead pencil after the names, after which these figures are checked by one of the other clerks. This being done the amounts are entered in the time book in the spaces provided for that day following the proper names. The amounts could of course be entered in the book at the time they were figured, without checking, but the above method insures correctness, and takes but little time, not over fifteen minutes longer.

Form 5 is the same as form 1, and is given to show the method of marking up the time of a molder working partly piece work, and partly day work, as some work frequently comes in which cannot be made by piece.

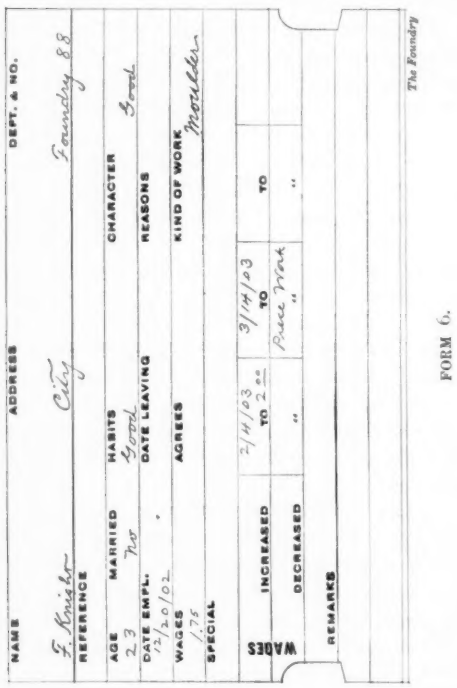
One week's pay is held back on the men to allow plenty of time for making up the pay-roll, and as soon as all the time is entered it is figured up, all cards made out, and both the book and the cards are footed. If the totals of the cards and the book agree, they are of course correct. A Comptometer being used for this purpose, it is not a long or difficult operation. This being done, each man is shown his card, and if correct according to his figures, he signs it, handing it in on pay-day when he gets his money. This does away with the delay of signing the pay-roll and prevents any man from seeing the amount or rate of pay of another workman, and avoids the countless wrangles that occur under systems that do not provide for a comparison before pay day.

As an auxilliary record, a card something similar to Form 6 may be used. These cards can be made out at the time a man is employed and kept in a file, alphabetically or numerically arranged during the time he may be employed, and in case of his leaving, filed in another file with the date and cause of leaving. The principal value of this record is that when a man is discharged the record shows why, and there is less likelihood of his being hired again, if his record was such as to show him undesirable. Where there is no such record kept, a dishonest or incompetent workman may be entirely forgotten after a time, and if rehired, the previous experience with him will be gone over with again. On the other hand, a man who has been employed at some time and proved himself competent and of good character, will have his former record card as a recommendation in case of his applying for a job at some future time.

The system described above has been tried out by the writer and found thoroughly prac-

tical. It provides for the checking of every point where mistakes would be likely to occur; without any great amount of clerical labor. It is very seldom that an error is made, the clock records being of course accurate, and by the plan of each man keeping his own time there is rarely any dissatisfaction among the day workmen, while the piece workers have ample time to make claims for shortages, etc., before pay day. It is very seldom, however, that there have been discrepancies in any department. In case of a mistake, it is satisfactorily adjusted before pay day, and in this way delays on that day are avoided.

We do not, of course, claim that this system



FORM 6.

is perfect, but we believe that there are points about it which may be of interest to many, especially to those connected with the pay-roll departments of the smaller foundries, and it is with this end in view that we present it to the readers of the *Foundry*.

The Shelby Foundry Co., Shelby, O., was incorporated by W. K. Hopkins, C. Howalski, Frank M. Cobb, Ben P. Bope and John M. Chamberlain. Capital, $10,000. The incorporators are practical molders. They have purchased the Shelby Stove Co.'s plant and taken possession of the foundry. It is intended to do a general jobbing business.

POINTS FOR BRASS FOUNDERS.

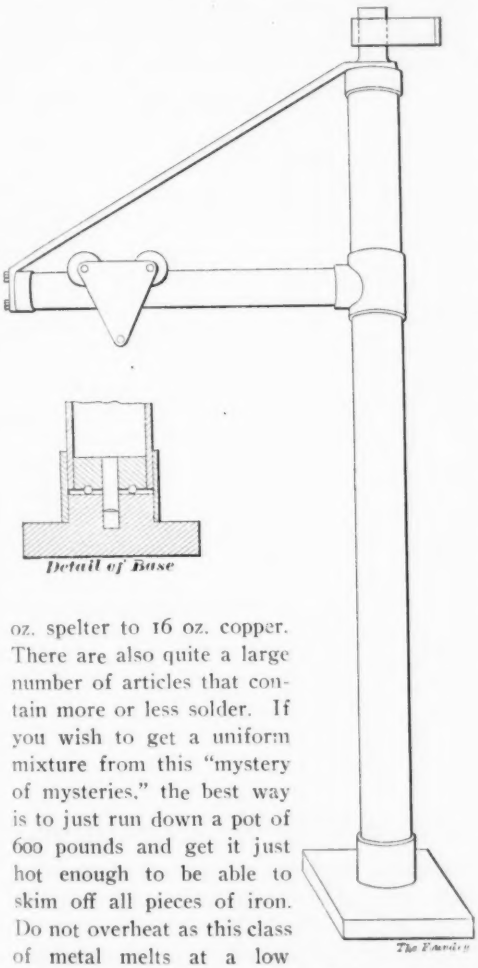
BY A PRACTICAL TRAVELING MAN.

Good morning, Mr. Blank, see you have made the changes suggested on my last visit. That is the only way to do business these times. Be up-to-date, or be "the real thing," as the boys call it. It will not take a long time to acquire a thorough knowledge of using old metal when you commence to think. That furnace for a No. 200 crucible is just what you need for running down light brass scrap. But my arrangements for lifting the pot out are not just what they ought to be. A jib crane is wanted and they ask from $300 to $400 for one and that is kind of steep for a struggler.

Oh, a jib crane will not cost much. You only want about 1,000 pounds capacity. Well, here is a sketch for one that you will find not only durable but inexpensive. Get a fair quality of old 4-inch pipe, have a blacksmith weld a piece in one end in which you can turn a groove for your balls to run in and also in which you can drill a pin hole for your bottom center pin, the rest can be put together easily with ordinary couplings. Use a tee for the point where the jib joins the mast. Place an ordinary stop-off on the top of the mast and on the end of the jib or in the top of the mast you can use a reducer to reduce from 4 inches to 1½ inches. Place a ¾-inch rod from the top of the mast to the end of the jib, as shown. You will want a good foundation, a square plate with the central part projecting and the same size of your mast will be all right. You will want to have a groove turned in this for the balls corresponding to the one in the bottom of the mast. The loose band dropped around the bottom will keep the dirt out, but leave it so you can lift it up for oiling. The wheels for your traveler should be made to fit the pipe, and a pair of triangular plates is all of the structure work which you need for the carriage. Use a chain block hanging from the pin of the traveler and your crane is completed.

What about light brass? Well, that is a "mystery of mysteries," but the same law holds good with this class of scrap metal as with others. We have in light brass scrap but two classes to deal with, namely: Common high brass and low brass. The high brass is high in alloy and the low brass is high in copper, so we have a peculiar combina-

tion of force to cope with, but a lesson learned and learned well will never be forgotten, so we will just take the time to explain this mystery. The sheet brass that is rolled and worked into various articles, represents several mixtures of high brass carrying from 30 to 40 percent spelter, and that class of soft sheet and light spun work carrying from 20 to 30 percent spelter is sometimes called 2 oz., 4 oz., 6 oz., etc., meaning 2 oz. spelter to 16 oz. copper. There are also quite a large number of articles that contain more or less solder. If you wish to get a uniform mixture from this "mystery of mysteries," the best way is to just run down a pot of 600 pounds and get it just hot enough to be able to skim off all pieces of iron. Do not overheat as this class of metal melts at a low temperature. If you use a little care you can get it perfectly clean. Pour into ingots for future use. Owing to the fact that small particles of solder have been melted into this metal, it will not admit of a very great amount of alloying. About 5 percent spelter can be added provided the metal is not too hard. That, the foundryman must be able to tell by the small test bar he pours out. To keep on the safe side when using this class of stock it is not advisable to use over 50 percent in any mixture; however, you must understand your work as I said in my previous talk with you. When you see me again you will get something else worth having.



Detail of Base

Who Pays the Bill?

Frequently it is desired to introduce into gray iron molds pieces of wrought iron or steel, as in the case of shafts for winding drums, or wrought iron or steel spokes for wheels. It is usual for the machine shop to furnish the foundry the wrought iron or steel pieces.

The question I would like to see settled, is the method in practice of accounting between machine shop and foundry for such parts.

The question is, should the machine shop furnish the wrought iron to the foundry free of cost, and the foundry charge back to the machine shop the entire weight of the castings, plus the weight of the wrought iron introduced, at casting price, or should the foundry deduct the weight of the wrought iron furnished it in billing the castings to the machine shop. This could easily be elaborated in other ways; that is, the machine shop could charge the foundry with the wrought iron, and when the foundry returns the completed casting, it could make a bill for the gray iron, deducting the weight of the wrought iron, and rebilling the wrought iron at the same price charged by the machine shop.

Some foundries claim the machine shop should furnish free all of the wrought iron and allow the foundry to bill it with the castings, on account of the fact that its introduction into the mold increases the molder's risk of loss, and that the machine shop is more than compensated for the cost of the wrought iron by being able to attach it to the cast iron so cheaply. Further, in the case of defective castings, from which the wrought iron could not be recovered in a practical manner, at whose cost should the wrought iron be furnished? From the writer's standpoint it would not matter whether the machine shop and foundry were under the same proprietorship or not, and he would be glad to hear the opinion of others on this question.

GRAY IRON.

The Richardson-Morgan Co., New York, has been incorporated to manufacture stoves and ranges. Capital, $30,000. Directors are: M. A. Rourke, New York; L. J. Waterbury, Brooklyn; and E. R. Harding, Hillsdale, N. J.

A CHEAP FIXTURE.

BY FRANK P. KLEINHANS.

There is scarcely a job nowadays which does not require a fixture of some sort to support the work while it is being machined. When the fixture is small the principal part of the expense is entailed by the work necessary to make it. When fixtures are large and heavy, however, the weight and consequent cost of the material used enter largely into expense; consequently it is well to study over the fixture so as to save both time and weight. The expense of casting some heavy fixtures is far in excess of the expense of machining and in other castings the cost of the pattern may be greater than the expense of both casting and machining.

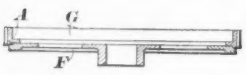


Fig.1

As a general rule, patterns which are round are more expensive than any others and it is in connection with fixtures of such a form that the patterns require turning that expensive patterns are often made. As an example, we have a fixture F, Fig. 1, which is required to hold the face gear of a large wheel lathe or forge lathe. This gear ring is shown at G. A recess A is turned on the gear for the purpose of centering it; we can, therefore, make a fixture which can be turned to fit into the recess and thus hold the gear while the teeth are being cut. This fixture is, of course, round and in order to avoid turning up the pattern, a sweep may be employed.

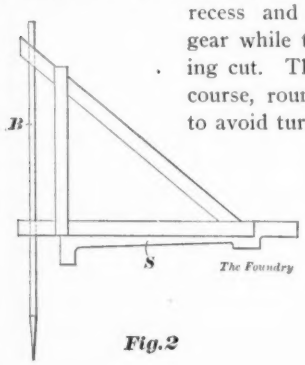


Fig.2

The sweep is shown at S, Fig. 2, and is made to conform to the cross section of the fixture. The bar B is driven into the foundry floor and is plumbed. The fixture is dropped down over the bar as shown and the mold is swept up. Care must be taken to have the spindle B plumbed as the surface of the swept mold should be level. If this casting were made solid it would weigh considerably over a ton. To reduce the weight we arrange a core box C as shown in Fig. 3, which is slipped down over the spindle. After the core box is in place the sand inside of it is loosened, the box filled with other sand, rammed up and struck off. The core box is then rapped and withdrawn. It is next lowered in position for the next section and the operation repeated. By repeating this process a fixture with six arms A is made. As it is not important to have the face of the casting present a good appearance, no cope is required. It is for this reason that the mold should be swept out perfectly level. In order to keep the green sand cores and the central core from floating they should be weighted down.

With this rigging a mold can be put up by one molder in a day, and as the pattern work on it is very simple, we obtain a fixture which is very cheap. This same method may be applied in making the castings for other forms of jigs and fixtures without the use of copes. It can also be applied to many odd jobs which are required every day.

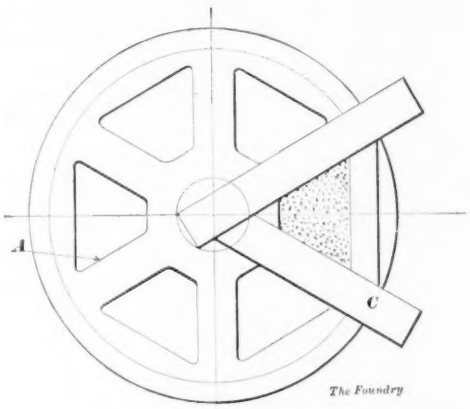


Fig.3

OBTAINING THE WEIGHTS OF ALLOYS.

In many instances it is desirable to obtain some idea of the weight per cubic foot of some one or other alloy before it is made up, and although this could not be an accurate weight, yet it is, generally speaking, near enough for practical purposes. Some metals lose in alloying or even melting, while others do not; and as examples we may take zinc and copper, the former losing considerably, while the latter, if clean, loses very little, for which reason a cubic foot of each of these metals would not produce two cubic feet of alloy, even assuming that such would be the case if there was no loss. And, again, it does

not always follow that 1 ft. of each of two metals will make 2 ft. of alloy without loss being made in the melting, as there are often reactions set up which will permit of metals mixing without increasing the bulk in proportion to the original bulks mixed. On the other hand, rolled or otherwise compressed metals when melted may well increase in melting to their original size as cast metal, and thus increase the bulk, although not the weight, of the ingot produced. For these reasons calculations can only be of a more or less approximate character.

For the purpose of foundry calculations it may, however, be taken that each cubic foot of metal used in an alloy adds a cubic foot to the bulk, making no allowance for loss; and if we add a cubic foot of one metal weighing 400 lb. to a cubic foot of one weighing 1,000 lb., we get two cubic ft. of alloy of a weight of 1,400 lb.—or, say, an alloy weighing 700 lb. per cubic foot; and on this we may base a fairly accurate estimate of the approximate weight of a casting containing a determinable cubic measurement. Taking the specific gravity of water as 1.000, and multiplying by 1,000, we get water as that number of ounces per cubic foot, and as the specific gravity of metals is based on that of water, as shown above, by the same arithmetical operation the weight in ounces per cubic foot is shown. In other words, if we move the decimal point three places to the right, our specific gravity becomes at once ounces per cubic foot, and the matter becomes extremely simple.

Taking the specific gravity of zinc as being 6.860, and of copper as being 8.788, we get 6,860 and 8,788 ounces per cubic foot respectively; and if we make an alloy of 34 percent zinc and 66 percent copper, by taking 34-100 of 6,860 and 66-100 of 8,788, and adding them together we get the approximate weight in ounces of a cubic foot of the alloy, which in this case will be 8132.50, so apparently showing a specific gravity of 8.132 and a weight of 508¼ lb. per cubic foot. Really, with an alloy of this mixture, the specific gravity would run out at about 8.30, and the weight per cubic foot about 518 lb. It will probably be found on analysis that where the proportions of metal shown above are used in making brass, the zinc content of the castings —alloy mixed and poured into ingots, and afterwards melted for pouring into the molds —will vary from 27 to 32 percent, depending on the care with which the manufacture has been performed, as considerable loss of zinc can easily be caused by bad management in melting. The reduction of the zinc, of course, increases both weight per cubic foot and specific gravity. Brass of the composition shown usually varies from 4½ to 5 ounces per cubic inch as cast, but if rolled the weight is considerably raised in the process, and to take the specific gravity of the rolled metal would be misleading if castings only had to be dealt with.

It is also as well to recollect that the proportions of each metal found in an alloy do not at all times agree with the quantities used in its manufacture, and for this reason there will often be some slight difference in the calculated weight as against the actual weight. the specific gravity of commercial metals also varies to some extent, and although the tables of specific gravities would be used for calculations, slight differences as against the actual weight and gravity of the alloys from this cause would be found.

At the same time it is usually near enough for foundry purposes to calculate the weight of alloys as previously shown, and both cost and weights of castings can be roughly ascertained by this method. The actual weight can only be found by weighing, and the real cost will only come out accurately after some of the castings are actually made; but still the calculations will be within 2 percent if reasonable care be taken.

Frequently remelting alloys causes considerable alteration in their composition, usually increasing their weight, and where aluminum is used it may be seriously reduced in two or three meltings, owing to its oxidizing into an ash with a small proportion of the metal it is alloyed with. Zinc works out if too much heat is used, but tin comes out less rapidly. For this reason runners and other scrap should be kept melted up with new metal, as this equalizes the proportion of waste, and metals liable to lose in melting should be melted under charcoal.—[By Walter J. May in the Mechanical World.

The Phœnix Foundry Co., of Ripley, O., has passed into the hands of a receiver, W. H. Armstrong being appointed as receiver. This company was operated profitably for many years by John P. Parker, but since his death has had no one to take care of it properly.

DIPPING BRASS.

The terms "dipping" and "pickling" are often used indiscriminately by many workmen, but wrongly, of course. Technically, there is a wide difference in the meaning of these two terms. The term pickling is used to designate the operation of removing the oxide from metal, usually after annealing, and as a weak acid is used the time consumed is, compared with dipping, necessarily much longer. A pickled surface is usually more or less mottled and lacks the uniformity of the dipped surface. In pickling the object is to remove the oxide and not to produce a beautiful surface.

In dipping the object is to render the surface perfectly clean, bright, and uniform in color. Usually a mixture of strong nitric and sulphuric acids is used and, as the action is quite violent and energetic, the length of time the articles are in the solution must be quite short, otherwise the surface will be attacked to such an extent as to render it rough and unsightly.

Large quantities of brass articles in both sheet and castings are put upon the market in a dipped condition, as it is both cheap and gives the article a good appearance. There are supposed to be certain kinds of brass mixtures called "dipping brasses" which take a much more satisfactory "dip" than some other varieties, and the alloy itself has been supposed to be part of the secret of success in producing a good dipped surface.

While too much stress, perhaps, has been laid upon the mixture for a dipping brass, yet there are certain ingredients in an alloy that greatly injures its adaptability for the purpose. The requirements for a good dipping brass, either of sheet, drawn brass or castings, are as follows: The metal must be free from blowholes or streaks. The structure must be homogeneous. The alloy should be uniformly attacked by the acid. Castings must be free from sand or other adherent matter.

In the case of sheet or drawn brass, such as rod or tubing, blowholes in the original plate or bar are, of course, elongated into streaks and, although they may not be very apparent before dipping, the removal of the skin in the process will render them very apparent and make the article unsightly. In reality the absence of these streaks is the quality which makes a good dipping brass and not the composition of the alloy. Their prevention lies in the original casting of the plate or bar from which the sheet or other material was made.

In castings, the same rule applies, except that the existence of blowholes will be revealed by the pinholes in the surface of the dipped article and not as streaks like those in sheet or rod. The melter again is responsible for their existence.

The lack of a homogeneous structure causes, both in sheet and castings, the surface to become mottled or irregular and lacks the necessary requirements for a salable article. This lack of homogeneous structure may be caused by several conditions. One and, perhaps, a principal cause is the presence of tin in the alloy. Tin, as is well known, has a tendency to separate or liquate from the parent alloy and form a composition which is not readily attacked by the acid. The color of the liquated portion is usually different from that of the main portion. The more quickly the alloy is cooled in casting the less the liquation. For this reason, therefore, sand castings are more apt to possess the property than sheet or rod as the raw material for the latter are invariably cast in metal molds. Lead will often liquate or segregate in the same manner. Spots of unalloyed iron often make their appearance on the dipped surface and antimony will also cause trouble. A brass, therefore, will give the best results when free from these admixtures.

The attacking of the alloy uniformly by acid is a property which is possessed by materials which are easily soluble in the acid itself. The brasses free from lead and tin possess it in the most satisfactory degree.

In sand castings the sand or other material which has burned or fluxed on the surface is an injurious feature; the small particles are not attacked by the acid and, unless the action commences underneath, they remain on the alloy. A tumbling process or pickling in hydrofluoric acid is usually necessary to remove them.

As for the color, there is little preference in the mixture. The low brasses appear to dip as well as the high. One need not fear that he is obliged to adhere to any certain mixture to obtain a good dipping brass.

A good dipping brass, therefore, is one in which the surface is free from imperfections and as free as possible from lead and tin. If in castings made in sand it is necessary (and, indeed, it usually is) to have these two elements present to obtain certain properties, the pouring temperature should be as low as possible to prevent the liquation and segregation of

them. In conclusion, it may be said that the best dipping brasses are those composed only of copper and zinc.—[Erwin S. Sperry in Aluminum World.

NOTES ON THE BRASS FOUNDRY.

BY CLARENCE E. WOODEN.

Antimony.—This is a grayish white metal which was discovered in the fifteenth century. It crystallizes in plates and the surface of a pig of it is covered with marks that look like foliage. Its specific gravity is 6.7 and it is sufficiently hard to scratch all of the softer metals and fuses at 810 degrees Fahr. Like zinc antimony burns at high temperature. Antimony is used in manufacturing alloys for car journal boxes and for different grades of babbitt and white metal, also for type metal. It is also used in great many brass mixtures to replace a portion of the tin. Antimony is considerably cheaper than tin and it requires only a small amount of it to replace the tin in some brass alloys. Ordinarily antimony and lead are used together in brasses. It should never be used in yellow brass as it is too brittle. It is not advisable to dip brass castings very hot when antimony is used in the mixture as they are liable to crack. Brass foundries frequently have trouble in using antimony in mixtures due sometimes to the use of an excess of antimony, and at other times to not using enough lead with the antimony. The best way to introduce antimony into brass mixtures is to melt the antimony and lead, pour it into small ingots and add it to the mixture in this form. When old scrap is used the antimony and lead can be used alone, but where the alloy is made from new metal it is best to use some tin in the mixture, and I would advise using a little phosphor copper or phosphor tin in either old or new metal.

Comparison of Brass and Iron.—The power of conducting heat is considerably less in red-hot iron than in copper and brass; hence the mold for brass should be drier than for iron, but in any case the presence of superfluous moisture is liable to cause injury to the molder as well as to the work. The larger the mold and the denser it is, the drier it should be. Sand used by iron molders is generally coarser and therefore more porous than that employed by brass founders.

Cause of Porous Castings.—Brass castings frequently come out porous on account of the use of too much new sand, on account of the sand being too moist, on account of too free use of the swab before drawing the patterns, on account of pouring the metal too hot, spilling metal that is poured too slowly and on account of the stopping up of the gates after pouring has started. If a casting is not gated heavily enough it will not only become porous, but will also cut. In steam metal it will become porous and will break at a very low pressure. In running a cheap metal containing considerable spelter a large vent should be used from the top of the casting as this will allow the metal to force the air, gases and oxidized metal out of the mold, thus resulting in a sound casting. When venting the mold with a small vent wire, the wire should never be allowed to strike the pattern as this will result in a dirty casting when poured on account of the fact that the small vent holes are not large enough to let out the dirt with the gas, hence the dirt settles into the casting. It is best to vent with a small vent wire within a quarter of an inch of the pattern.

From the above facts it is evident that green sand cores cannot be used as easily in brass castings as in iron castings, though progressive foundrymen are using them successfully in many cases. Usually the brass foundryman tries a green sand core and if it blows, or the metal eats into the core where the gate comes, he becomes discouraged and gives up any attempt to use this class of cores. The eating into the core opposite the gate can be prevented by brushing some black lead on the side of the core at this point. Green sand cores when used should be thoroughly vented, but there are many cases where dry sand cores are better.

Use of Glue in Molds.

The writer has been using glue in molds to prevent parts of the mold cutting or dropping either during pouring, or on account of their being drawn down by the heat of the rising metal. He has been using a glue about half as strong as should be used in gluing patterns in castings where there was a difficult lift; in other castings he has used weaker. After the mold is thoroughly dried, or skin dried, the iron will lie against the glue without any bad effects. I should like to know what experience others have had along this line.

ED SCHULTE.

The Utica Steam Engine & Boiler Works have elected the following directors: J. A. Omens, A. E. Omens, N. F. Omens.

CAST IRON NOTES.

Devoted to inquiries from Practical Foundrymen on the subject of Melting and Using Cast Iron. Address all inquiries to W. J. KEEP, care of The Foundry.

Shrinkage of Pig Irons and of Mixture.

Question. "I give below the shrinkage of five pig irons and of a mixture containing these irons and scrap. From a long list of tests of iron and mixtures I find that 95 percent of the mixtures show a lower shrinkage than that of the individual irons. I fail to understand this as the absorption of sulphur from fuel, reduction of silicon, etc., increase shrinkages; yet my results show a decrease in shrinkage.

"All tests are made under the same conditions as near as possible regarding condition of sand, ladle and temperature of iron. The shrinkages of these irons were .150; .149; .146; .144; .142; and of mixture (⅜ scrap) the shrinkage was .136 inch using a ½-inch test bar."

Answer. The facts agree with the general experience. The conditions may not have been alike; the pig irons may have been melted in a much colder cupola or crucible. Iron that comes down first from a cupola may have a shrinkage of .160 inch and the last iron 2½ hours later may have have a shrinkage of .125 inch. But this is not all. The shrinkage of a pig of iron remelted in a crucible or in a cupola is not always in proportion to the chemical composition. For example, the calculated silicon in a mixture was 3.03 percent and of sulphur, .025 percent by analysis of casting silicon 2.91 percent and sulphur .054 percent, a loss of .024 percent silicon and a gain of .029 percent sulphur. The shrinkage of the six irons in the mixture was .187; .120; .137; .134; .152; .148 and of the casting (35 percent scrap) .124.

Another case, one pig iron 1.25 percent silicon, shrinkage .168; another pig 4.70 percent silicon, .156 shrinkage. A mixture 2.50 percent silicon, shrinkage .143 inch. All of these irons were melted in a crucible under uniform conditions. The casting mentioned in the first case was melted from the mixture in a cupola and these pigs and the casting were melted in a crucible to obtain the above results. The strength in each case was greater than any part of the mixture.

It looks a little as though it was a difficult thing to calculate the physical quality of a mixture from either the physical or chemical quality of the pig irons entering into a mixture. The safest guide is to measure the shrinkage of your casting, and so long as you use that mixture, if you keep the shrinkage the same, the physical quality will be substantially the same. If the shrinkage changes, the chemical composition of some of the irons has changed and the silicon must be altered until the shrinkage comes back. Chemical composition and physical quality vary nearly together for any given mixture.

I have just received this information in a letter. "You will be glad to know that since we have used the shrinkage test our iron has come better than ever before and the machine shop foremen tell me that it has never before been so even and uniformly good."

Proportions of a Cupola.

Question. "Our cupola is 50 inches internal diameter, straight lined, tuyeres 16, each 5½ x 4½ inches and 16 inches above sand bed. Wind belt 12 inches wide by 24 inches high. Positive pressure blower speed 175 revolutions per minute. Diameter of outlet 20 inches, blast pipe 130 feet long and 20 inches diameter. I am but recently employed by the firm as chemist and have suggested the following changes: 1st. To lower the tuyeres to four inches above sand bottom (we make light castings about like stove plate). 2d. To increase area of inner ends of tuyeres. 3d. To make wind belt 12 inches wide by 36 inches high or even a greater increase. 4th. To make blast pipe 28 inches diameter in view of the great distance from blown to cupola.

"What effect would the lowering of the tuyeres have on the proper mixing of the irons as they come down? We use some cheap, high silicon iron, some high phosphorus irons and average down the phosphorus with high silicon malleable Bessemer iron running .11 to .15 P. Would we be liable to get down the high phosphorus iron and low phosphorus irons so far apart that one casting would not be uniform with the low tuyeres? About how much reduction in our bed of coke would be right for the lower line of tuyeres?"

Answer. Everything about your outfit is exactly right as it is. Don't change it in any way. You cannot melt with coke with the tuyeres much nearer the bottom. You can melt with low tuyeres if you were to use anthracite coal. The iron would mix thoroughly

with low or high tuyeres, but it is better to keep the melted iron about six or eight inches deep in the hearth by making a small tap hole.

It is not necessary for you to reduce phosphorus with an expensive iron. For thin castings 1 percent of phosphorus will not lessen strength. As your coke bed should reach the same distance above the tuyeres whether they are low or high, you can figure the difference in bed.

Sulphur in Coke.

Question. "We have received a lot of coke that must contain too much sulphur, we think, for we get hard castings. Is there any way to avoid throwing out such coke altogether?"

Answer. There is no practical way to take the sulphur out of such coke. You should never purchase such coke. If you could put about 10 pounds of ferro-manganese into the cupola with each ton of iron melted, or an equal quantity of powdered ferro into the ladles before filling with iron, it would help. If you use a liberal supply of oyster shells or marble chips or limestone, say 40 pounds to each ton of iron, it would help. Increase the silicon in your mixture until the iron is soft and you may find that your trouble is more a lack of silicon than too much sulphur.

Stove Founding.

Question. "The foreman of the shop in which I am employed has put some new stoves in the sand. He simply took the stoves apart, had each piece fellowboarded, put a little wax on with a hard brush and sent them to the molders from which he expects smooth castings. Some of the patterns are nickel plated. Will you please inform me how to treat these patterns?"

Answer. You could not in any way make those castings fit for patterns to cast from. Stove patterns are made with just enough play in the joints between the different parts to allow the pieces to fit close without filing. A molder raps each piece in the mold, some more and some less, which reduces this play. While the patterns fit very loose, the stove will fit close. The molder will strain, that is will make his casting anywhere from 10 percent to 20 percent heavier than the pattern. Molders are generally very careless about trimming gates—a casting is often twice as thick under the gate as it should be. If such castings are used for patterns, the stoves would be 25 percent heavier than they should be and it would cost twice as much to put the pieces together as with casting with sufficient play. The unevenness of the castings would cause the stoves to crack. To make a smooth stove casting, the patterns must be filed smooth and of an even thickness. The only way to get good patterns is to have them molded specially and run the iron exactly opposite from the way it will be run in the casting, then file carefully and fit all joints to give proper play.

NEW BOOKS.

Year-book of the Iron Industry. Published by Stahl & Ersen, Duesseldorf, Germany. Price 10 marks. The second volume of the annual compilation of titles and patents relating to the entire iron industry, gathered under the auspices of the German Iron and Steel Institute, and published by August Bagel, of Duesseldorf, lies before us. It is a substantial, well-printed work of 464 pages, and takes up the subject for the year 1900-1901. As we page through the work, we note that the subject matter is very well classified, and the attempt made to give all the information possible in the most concise way. After some historical matter, fuels are taken up, references to articles and patents on wood distillation, charcoal, turf, coals, gas, oil, pyrometry, and the production of high temperatures following in regular order. The string of refractories, as we know them, then slag and slag cement, together with briquetting fuel and ore are discussed. A welcome part of the book is the discussion of the ores of iron, manganese, chromium, nickel, cobalt, titanium, tungsten, molybdenum, and vanadium. Of several of these we like more information here. The Blast furnace with all its accessories, arrangements of iron works, the products made, even into the smallest details, are touched upon, sometimes with much explanation, but generally with the mere title and the place where to find the article. The physical and chemical properties, and the testing of the materials made winds up the book.

The profuse illustrations of the work make it more valuable than the compilation of the same material by the Iron and Steel Institute of England. In the preface we find the mention of an axiom which says: "The next best thing to knowing a thing, is knowing where to find it." The truth of this is self-evident to the active man of affairs. It, however, leads us to a few remarks which may be of interest to our German friends. While the volume is

undoubtedly a valuable one to the German ironmaster, it is much less so to those of other countries because of two facts. First, the list of references is far from complete, many an important article having been overlooked. This is, in a great measure, due to the absence of some of the most important trade papers from the list of journals consulted. It should be easy to remedy this. Secondly, the time elapsing before the compilation sees the light of day is a bad handicap to the success of the yearly volume, leaving it far behind its English rival. Imagine a foundryman looking up some subject for information, and finding that the volume just received ends with the articles appearing in the fall of 1901. What has not been done in the meantime. German thoroughness, in this instance, has been a little behind hand. We should imagine, from our own experience, that as the journals come in, the references are made at once, and filed under suitable heads. Now when the year 1901 was finished, without waiting for the papers coming from Australia, the index could be started and the whole manuscript be in the hands of the printer within two months. Two or three months thereafter this information should be in the hands of the public. It would then be valuable in a much greater measure than it is now. We hope that when we get the next volume, at the end of this year, it will bring the subject up to the end of 1903.

Beyond these few criticisms, which are in all probability fully understood on the other side, we can recommend the adding of this volume to every reference library of the country.

The Derry-Collard Co., of New York City, has issued a new edition of its little book entitled "Machine Shop Arithmetic." While intended primarily for the machine shop, this work certainly contains a great deal of material which would be of interest to all foundrymen and should be in the hands of every mechanic. Price, 50c.

It has also issued No. 4 of its series of practical papers entitled "Threads and Thread Cutting." This work will be invaluable to all who are interested in this line. These practical papers are issued with a neat, strong paper cover at a uniform price of 25c each.

"Business Management" is the title of a volume issued by the American Academy of Political and Social Science, of Philadelphia, Pa. This volume will be sent postpaid to any address for $1.25. It contains articles on a number of live topics, such as "Fire Insurance," "Rates and Methods," "Trade Unionism," "The "Value of Auditing to the Business Man," "Importance of Cost Keeping to the Manufacturer," "Advertising," and other equally interesting articles. The names of the authors of these articles are so well known that they cannot help but carry weight with them.

"The Iron and Steel Metallurgist and Metallographist" is the new name under which "The Metallographist" appeared Jan. 1. The first number of the paper contains a number of interesting articles and reviews, and we certainly wish it success.

TRADE PUBLICATIONS.

The Knowles Steam Pump Works, of New York City, have published a book of 150 pages illustrating and describing different types of direct acting steam pumps, electric pumps and belt driven pumps; also air compressors and ammonia pumps manufactured by them.

Hammacher, Schlemmer & Co., of New York City have published a little pamphlet entitled "Fifty-five Years at It," in which they give a short statement as to what they sell, and as to what their various catalogues contain. From these, the purchaser will find that he can obtain a very wide range of supplies from this house.

The Yale & Towne Mfg. Co., of New York City, has issued a small folder, 3½ x 6 inches, entitled "Three Labor Savers," in which it describes its Triplex, Duplex and Differential chain blocks, and gives the relative advantages of each.

Kendall & Flick, dealers in manganese, Washington, D. C., have issued a four-page folder, 3 x 6 inches, entitled "Looking Backwards and Forwards," in which they tell of the progress made in the preparation of manganese products for foundry use.

M. H. Treadwell & Co., of New York City, have issued a four-page folder, calling attention to the ways in which they are ready to serve the trade, and also an eight-page folder describing and illustrating the ladles which they manufacture.

The Laidlaw-Dunn-Gordon Co., of Cincinnati, O., has issued a small catalogue, 3½ x 6 inches, describing the new Cincinnati Air and Gas Compressors manufactured by this company.

The Northern Engineering Works, of Detroit, Mich., have issued a catalogue of their

traveling cranes, illustrating various installations for foundry and other uses The catalogue is very neatly gotten up.

The Northern Electric Mfg. Co., of Madison, Wis., has issued a neat catalogue, illustrating and describing its Motor Operated Valves. These valves are used mostly in connection with water-power, but can be used for any purpose where it is necessary to operate heavy valves.

The Brown & Sharpe Mfg. Co., of Providence, R. I., has issued a new edition of its catalogue of machinists' tools and measuring instruments.

C. W. Thomas Co., of Detroit, Mich., successor to the Michigan Brass & Iron Works, has issued a catalogue, entitled "Catalogue B," in which it describes the valves for steam, water, gas, etc., and general water plant supplies manufactured by this company.

Herbert V. Falk, 27 Pine street, New York City, has issued an eight-page folder, in which he describes a new product which he terms Partmol. This is a new dusting compound for parting molds. It is intended for use with iron, brass, bronze, aluminum and other metals, and is claimed to be as good as Lycopodium for brass or bronze work, and to be a perfect parting and dusting compound for iron work.

The Power Mining Machinery Co., of New York City, has published a neat catalogue, describing the gas engines manufactured by this company. The relative efficiency of the gas engine and steam engine is illustrated in a very graphical manner by means of areas printed in black.

The Buffalo Forge Co., of Buffalo, N. Y., has issued three catalogues, 3½ x 6½ inches. One describing its Mechanical Induced Draft apparatus, another describing its Volume Blowers and Exhausters. The third is second in a series, entitled "Engineering Lore Series." It describes a test of a compound engine installed by this company at Cornell University.

Rogers, Brown & Co., of New York, have issued a neat little folder, entitled "Kish, Son of Carbon," in which they tell something of the nature of Kish. On another page we are reproducing this article complete. In the form in which the company is sending it out it is printed on rough surface paper and bound with a very neat embossed black cover.

The Pneumatic Tool Department of the Ingersoll-Sergeant Co., of New York, has just issued a calendar showing one of their Haeseler pneumatic hammers in use on a "sky scraper." In the center of the calendar, the axial valve used in this hammer is worked in a novel manner.

The Duisdieker Foundry & Mfg. Co., of Pekin, Ill., manufacturer of art vases, settees, etc., and of agricultural machinery, has gotten out a very neat souvenir in the shape of a medallion of a girl's head, twelve inches high. The hair is painted with aluminum paint, and the face bronzed. It has also gotten out two very neat calendars and a catalogue describing its vases.

The Smooth-On Mfg. Co., of Jersey City, N. J., has gotten out a neat calendar for 1904, and has also issued a booklet telling about Smooth-On, its different combinations and their applications. The latest combination is Smooth-On with rubber, in the form of sheet packing, which will resist high temperature and high pressures.

Curtis & Co. Mfg. Co., of St. Louis, Mo., has issued a neat catalogue of its pneumatic machinery.

The Buckeye Pig Iron Co. has sent out a neat souvenir which is supposed to be a buckeye, upon which the words Pig Iron have been cut. The buckeye is sent out in a small tin box. The only joke about the matter is that the buckeye is a horse-chestnut, but we do not see that this will injure its advertising value, or the quality of the pig iron.

The Diamond Machine Co., of Providence, R. I., manufacturer of polishers' and grinders' machines, has sent out a neat souvenir in the form of a key-ring and screw-driver. The company's advertisement is stamped on the screw-driver.

McCullough-Dalzell Crucible Co., of Pittsburg, Pa., has issued a neat calendar for 1904, giving a view of its works.

J. W. Paxton & Co., of Philadelphia, Pa., has issued a 1904 calendar having a picture of a Fencing Girl upon it.

The Chicago Pneumatic Tool Co., of Chicago, Ill., has issued a sheet describing its new air compressor which is designated especially for driving pneumatic tools. This machine is provided with pressure regulators, and has been designed throughout to adapt it specially for the service for which it is intended.

The American Brake Shoe & Foundry, of Chicago, Ill., has issued a neat little catalogue, 6 x 3½ inches, describing cast steel tools made from Tropenas steel.

ASSOCIATIONS AND SOCIETIES.

Philadelphia Foundrymen's Association.

The regular monthly meeting of the association was held at the Manufacturers' Club, Jan. 6, President Thomas Devlin occupying the chair.

The treasurer reported a balance of $1,807.77 on hand and all bills paid. E. E. Brown, chairman of the committee of the association of the foundry exhibit for the St. Louis Exposition, reported that, as a result of an appeal to the members, about $1,500 had been pledged toward Philadelphia's contribution to the general fund. A letter from the Franklin Institute was read, inviting the members to be present at the Institute on the evening of Jan. 7 to hear a lecture by A. E. Outerbridge, on the results of some recent investigations in cast iron. The paper of the evening was by N. Lilienberg, of Stockholm, Sweden, entitled, Side-Blown Steel Converters, and was read by J. S. Hibbs. The paper was followed by some discussion.

The quiz class question for the evening was, "Does high silica facing resist the action of hot steel in making steel castings to a greater extent than high carbon facing?" Replying to the question, Secretary Evans read a letter from Bradley Stoughton, in which he said it does; and further, high carbon facing sometimes makes blisters on the surface of steel castings where carelessly applied.

Pittsburg Foundrymen's Association.

The monthly meeting of the Pittsburg Foundrymen's Association was held on Monday evening, Jan. 4. President A. W. Slocum was unable to attend, owing to an illness, and the meeting, owing to the small attendance, was informal. J. A. Holmes, chief of the department of mines and metallurgy at the St. Louis Exposition, was present and presented in detail the proposal for a foundry building in connection with that department.

Milwaukee Foundrymen's Association.

The regular meeting was held in the club room of the Pfister Hotel, Jan. 12. An informal dinner was given to the foundrymen of the city, and hereafter this will be an annual affair. W. J. Turner, president of the Northwestern & Malleable Gray Iron Mfg. Co., was chairman and toastmaster for the evening. The program included addresses on the subjects named, by the following gentlemen:

The National Founders' Association, by Irving H. Reynolds; American Foundrymen's Association, by Chas. E. Sammond; The Milwaukee Foundrymen's Association, by Thos. W. Sheriffs; National Association of Manufacturers, by Frederick W. Sivyer; The Employer's Rights, by A. J. Lindemann; The Next Molders' Agreement, by O. W. Greenslade. A paper prepared by Capt. I. N. Bean, of the Northwestern Iron Co., Mayville, Wis., on the business situation was read by Fred M. Prescott, in the former's absence. The dinner was given largely for the purpose of bringing the foundrymen of the city together for an interchange of ideas and with the hope of increasing the membership of the organization, there being a few foundrymen in Milwaukee who are still not members.

At the business session previous to the banquet, Walter Reed, president of the Filer & Stowell Mfg. Co., was elected president of the association to fill out the unexpired term of T. N. Neacy, of the same company, who resigned. W. J. Fairbairn, secretary of the Metal Trades and Founders' Bureau, of Milwaukee, was elected secretary to succeed T. W. Sheriffs, who had resigned.

Southwestern Foundrymen Meet.

On Dec. 14 the Southwestern Foundrymen's Association met in the Baltimore Hotel, Kansas City, Mo. There were present representatives from the various parts of Kansas and adjoining states. In the evening the visiting members were entertained at a Dutch lunch given by the Metropolitan Club, of Cincinnati.

Banquet in Honor of I. W. Frank.

The Pittsburg foundrymen gave a banquet in honor of I. W. Frank, who was recently elected president of the National Foundrymen's Association at their meeting in Washington, D. C. The banquet was at the Union Club. The guests included about forty of the leading foundrymen in the city. The new president is identified with some of the most important enterprises in and about Pittsburg, being president of the United Engineering & Foundry Co., treasurer of the Empire Coal Mining Co., a director of the Duquesne Steel Foundry Co., and of the Iron City National Bank and Guarantee Trust Co. He is also connected with the Great Lakes Engineering Co. of Detroit. Mr. Edward Kneeland, of the United Engineering & Foundry Co., was toastmaster, and a number of informal speeches were made.

Chicago Foundry Foremen's Association.

Mr. J. H. Homes has resigned his position as secretary of the Chicago Foundry Foremen's Association, and has been succeeded by Mr. Geo. C Nielsen, foreman of the foundry of the Henry E. Pridmore Co., 19 Rockwell street.

PERSONALS.

Mr. J. H. Homes, who has held the position of foreman of the Brown Bros. Mfg. Co., of Chicago, has resigned his position and accepted a position with the L. Schreiber & Sons Co., of Cincinnati, O.

Mr. Charles Milles, assistant foreman of the Brown Bros. Mfg. Co, of Chicago, has been promoted to the foremanship on account of the resignation of Mr Homes.

David Logan has resigned his position with the Syracuse Stove Works. He has been foreman of the foundry for 16 years.

Mr. Joseph Harrison, foreman of the big foundry of the Allis-Chalmers Co. at West Allis, has retired on account of ill health and is now in California. For twenty years he has been foundry foreman for the above named company; one year at the West Allis foundry, and nineteen years at the reliance shop.

Mr. Sol Shaw, president of the Milwaukee Foundry Foremen's Association and for ten years foreman in the South foundry of the Allis-Chalmers Co., has been appointed general foundry foreman of their reliance shop.

Mr. Henry Biegel, foreman of the reliance foundry of the Allis-Chalmers Co., has been appointed foreman of the big foundry plant at West Allis.

James T. Wakeman, general manager of the Eagle Foundry & Machine Co., Alliance, O., has been elected general manager of the Farmers' Mfg. Co., of that city. Mr. Wakeman will, for a time, retain his present position in addition to discharging the duties of his new position.

B. C. Watts, who has been supply agent for the Jeffersonville branch of the American Car & Foundry Co., went to St. Louis Dec. 26 to become assistant to W. E. Hedgecock, general purchasing agent for the company.

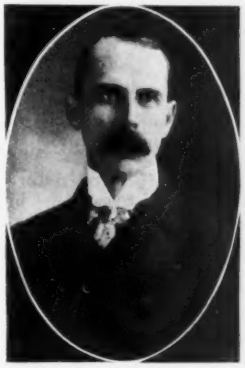
Carl Forsman, who has held the position of instructor in the foundry department of the Polytechnic Institute at Worcester for several years, has resigned his position. He has not announced his plans for the future.

Isaac Fleet, foreman of the foundry of the Sullivan Machinery Co., at Claremont, N. H., was presented with a valuable gold watch by the men under his charge on Dec. 24. The presentation was made by M. Coughlin, who made a speech expressing the respect and good feeling that all of the men had for Mr. Fleet and asking him to accept the watch as a token of their friendship and wear it that it might remind him of the confidence the workmen had in him. Although taken completely by surprise, Mr. Fleet recovered himself sufficiently to make an appropriate reply.

Rogers, Brown & Co. have added to their firm Mr. Arthur A. Fowler, formerly of the firm of A. A. Fowler & Co., Produce Exchange, New York. Mr. Fowler will reside in New York and be connected with the Eastern interests of the company.

DEATHS.

Frank E. Rose, foreman of the foundry of the McCormick Harvesting Machine Co., dropped dead while inspecting some of the work at Western avenue on Dec. 18. For some time Mr. Rose had been complaining of pains in the region of the heart. The deceased formerly had charge of the Malleable Iron Works, Dayton, O. He was 40 years of age and is survived by his wife and one daughter.



FRANK E. ROSE.

John Lindsay, vice president of the Bay City Iron Co., Bay City, Mich., died Jan. 8, aged 65 years. Mr. Lindsay had been a resident of Bay City for 40 years.

William Hamlin Hiester, treasurer of the Pottstown Iron Co. for many years, died Jan. 14 at his home in Pottstown, Pa., aged 47 years.

James F. Yeats, aged 76 years, died Dec. 10 at his home in Owosso, Mich. Mr. Yeats was a pioneer foundryman and manufacturer of windmills, and was a member of the firm of Yeats & Osborn.

Col. H. M. Boies, a prominent citizen of Scranton, Pa., died Dec. 11, aged 67 years. In the spring of 1882 Colonel Boies became president of the Dickson Mfg. Co., which position he held for four years, during which the com-

pany enlarged its plant and introduced the hydraulic system of flanging and riveting. He invented a steel-tired car wheel, now manufactured by the Boies Wheel Co., of which he was president. He was identified with a number of social, religious and charitable institutions.

Paul Richter, president of the Richter Iron Works Co., Denver, Col., was accidentally shot and killed Dec. 13 by a companion with whom he was on a hunting trip east of Denver.

FIRES.

The iron foundry, enameling and bath tub works of the Henry McShane Mfg. Co., Baltimore, Md., were destroyed by fire on Dec. 21. The loss is estimated between $40,000 and $50,000. Andrew Burns, who was employed at the plant as watchman, lost his life in the fire. It is supposed that he was suffocated by the smoke before the fire reached him. The company had gone into a receiver's hands on Nov. 27.

The pattern storage building of John Inglis & Son, Toronto, Ont., was destroyed by fire on Dec. 27. The greatest loss is the patterns.

The pattern storage building of the Laurie Engine Co., at Toronto, Ont., was gutted by fire on Jan. 7, involving a loss of $15,000. The foundry suffered slightly from water.

The plant of the Maysville Foundry & Machine Co., Maysville, Ky., was damaged by fire on Dec. 16. The loss was confined largely to patterns stored near the cupola. The fire was extinguished by the prompt action of the employes.

The iron and brass foundry of James W. Carr, Richmond, Va., was destroyed by fire on the night of Dec. 23. The loss was from $20,000 to $25,000, with no insurance.

The plant of the Ashland Foundry & Machine Works, Ashland, Wis., was slightly damaged by fire on Dec. 29.

The wagon works and foundry of the Ruka Bros. Mfg. Co., Boscobel, Wis., were destroyed by fire on the night of Dec. 27. Loss, $15,000, no insurance.

The foundry of the Alamo Mfg. Co., maker of gasoline engines, located at Hillsdale, Mich., was completely destroyed by fire Jan. 7. The loss is large, but it is covered by insurance. The directors had just voted to increase the capital stock from $300,000 to $500,000, and to use the additional money in enlarging the capacity of the plant.

Waterloo, Ia., was visited by a serious fire on Dec. 14 in which the foundry of the Cascaden Co. was destroyed, the patterns and books being all that were saved. The building was jointly occupied by the Cascaden Co., the Waterloo Motor Works and the Cascaden Mfg. Co. The total loss will aggregate $80,000, which was partially covered by insurance. The Cascaden foundry was established in 1872, and it is reported that the plant will be rebuilt at once.

The foundry of Lyle & Reynolds in Crawfordsville, Ind., was damaged by fire on the morning of Jan. 7. The roof of a portion of the building was completely destroyed and the interior damaged to some extent. The total loss will be about $600; about half covered by insurance.

The Columbia Foundry plant at Cincinnati, O., was destroyed by fire on Jan. 9, the damage amounting to $7,500.

The Eureka Foundry Co., which adjoins the Columbia Foundry Co. in Cincinnati, was damaged to the extent of $500 by the fire which destroyed the Columbia plant.

Fire recently destroyed the pattern shop and foundry of Miner Seating Co., Canal Dover, O. Loss, $16,000; insurance, $8,000.

The plant of the Morning Star Thresher Co., Napoleon, O., was burned Jan. 1. Fire started in the foundry department. Loss $80,000, with $10,000 insurance.

Fire of unknown origin partially destroyed the foundry of the Aultman & Taylor Co., Mansfield, O. Loss $10,000, covered by insurance.

The plant of the Lancaster Malleable Iron Works, Lancaster, N. Y., was destroyed by fire Dec. 21. Loss $8,000, covered by insurance.

The Cedar Point foundry at Port Henry, N. Y., owned by A. Tromblee & Sons, was burned to the ground Jan. 7. The machine shop was saved.

Slight damage was done to the foundry of the Finch Mfg. Co. in Scranton, Pa., by fire on Jan. 7.

The Davis & Furber Machine Co., North Andover, Mass., had its pickling department and scratch rooms destroyed by fire on Dec. 23. Loss $1,500, which was covered by insurance.

The factory of the Williams Stove Lining Co., of Taunton, Mass., was completely destroyed by fire on the night of Nov. 29, entailing a loss of $30.000. They will rebuild at once.

STOVE PLATE MIXTURE.

In your January edition on page 239 the writer notes an article as follows:

"A stove plate mixture should have about 3 percent silicon and the sulphur should not exceed .75 percent, but it is very likely to be as high as .90 percent." These percentages of sulphur, .75 percent and .90 percent respectively, are evidently mistakes and should probably read .075 and .090.

In reply to a query on this page I also note as follows:

"The higher the silicon the stronger the castings." This I have never known to be a fact, and in all my experience in making mixtures by anaylsis I have always looked upon silicon as a weakener and my results have always proven this to be a fact.

Further, as No. 3 iron (to the best of my knowledge) is from 1.50 to 2.00 silicon, therefore I do not see how a No. 3 iron would soften a mixture of one-half machinery and one-half stove plate scrap, as both of the latter named are higher in silicon than a No. 3 iron and just as favorable in other elements, unless it be sulphur, which no doubt is higher in scrap than pig iron, but not enough to offset the effect of the higher silicon in two scraps.

Hoping, if the above is correct, you will place this before the founders for their benefit, I am, Your truly,

C. C. KAWIN.

NEW CONSTRUCTION.

The Union Pacific railroad is planning to build a new foundry, 102 x 264 feet, in connection with its shops at Omaha, Neb.

Work has been commenced on the construction of the new foundry at the Puget Sound navy yard. The building, which will cost $69,000, will be erected by the Congress Construction Co., of Chicago. It is expected that the plant will be in operation in about seven months.

The Hoquiam Iron Works, Hoquiam, Wash., have purchased two lots and intend erecting a complete up-to-date machine shop and foundry. There will be two buildings, each 50 x 100 feet.

The Koch Mfg. Co., of Grinnell, Ia., organized by H. W. Spaulding, J. C. Goodrich and A. A. Koch, has about completed the construction of buildings for its new plant. The machine shop is 60 x 100 feet and two stories in height, and the foundry 40 x 60 feet.

The De Laura Auto Mfg. Co., Fort Dodge, Ia., has enclosed the main portion of its new foundry building and hopes to have it in operation before long.

The Southern Foundry Co., Dallas, Tex., recently incorporated, has leased a plant and is now operating it. The company does not contemplate building at once, but expects to do so before the end of this year.

Thirty acres have been purchased by the Denver Steel Casting Co. as a site for its new plant. Work on the buildings will be commenced within 30 days, and it is expected they will be under roof by July 1.

The Purcell Foundry & Machine Co. is planning to build a new foundry at the town of Purcell, Mo. This is located in the mining region in a place where a foundry has been needed for some years.

The National Iron Co., St. Louis, Mo., has commenced the erection of a plant at East St. Louis, Ill., adjoining the St. Louis locomotive plant. The new plant is intended for the manufacture of small castings.

The Missouri Moline Plow Co., St. Louis, has purchased a site and will erect a large plant for the manufacture of farming implements.

The Brandon Machine Works Co., Brandon, Ont., will build a new foundry.

The Guelph Foundry Co., Ltd., of Hamilton, Ont., is erecting an extension, 104 x 68 feet, to its works.

O. P. Chatfield, of Escanaba, Mich., is about to erect a new brass foundry and core oven in connection with his plant at Escanaba. Mr. Chatfield also has a brass foundry at Marinette. He expects to run the latter through the winter, after which it will probably be closed or sold, or transferred to the Escanaba plant.

The Carl Hirsch Iron & Rail Co., Covington, Ky., has purchased ten acres of ground from the Big Four railroad and is going to build a foundry at once. It expects to employ 100 men.

The Strickland Machine Co. has leased a plat of ground from the city of Tuscaloosa, Ala., and will proceed to build a machine shop and foundry plant.

The United States Cast Iron Pipe & Foundry Co. will make improvements at its plant at Anniston, Ala., which will greatly increase its capacity.

Col. J. W. Gresham, who has been manufacturing buggies at Griffin, Ga., is adding a foundry to his plant to furnish his own cast-

ings and do a general foundry business for other concerns in the region.

Price & Evans, Chattanooga, Tenn., have begun to rebuild their foundry which was recently destroyed by fire.

J. R. McWane, of Richmond, Va., and other citizens of Lynchburg and Richmond are organizing a company to erect a steel casting plant at Birmingham, Ala. The capital will be $50,000 and the plant will be erected at a cost of about $25,000.

The Greenless Bros., of Rockford, Ill., are rebuilding their plant. The machine shop is to be a one-story building, 160 x 250 feet, and a foundry, 80 x 150 feet, in addition to which there will be another building for core-room and other departments.

The University of Illinois at Champaign, Ill., is about to erect a new foundry at a cost of $10,000.

The Galesburg Machine Works, Galesburg, Ill., have just completed a new foundry building which will be placed in operation in the spring.

A contract has been made by the American Radiator Co. with the city council and the board of trade of Litchfield, Ill., by which a plant that will employ about 250 men will be located at Litchfield.

The Frankfort Brass Works, Frankfort, Ind., which recently suffered a $3,000 loss from fire, will rebuild and enlarge their plant. To accomplish this they are issuing $10,000 worth of bonds.

M. F. Gartland has let the contract for his new foundry, heretofore mentioned, which is to be built at Terre Haute, Ind. The plant will be considerably larger than at first contemplated.

The South Bend Foundry Co., South Bend, Ind., gave a shop-warming a few evenings since for its employes, the occasion being the dedication of the company's new foundry. The main building is 302 x 60 feet. The company manufactures the Perfection chilled plow and does general foundry work.

The Morning Star Mfg. Co., Napoleon, O., whose plant was recently destroyed by fire, advises us that it will begin at once to build a brick building, 50 x 200 feet, and a foundry disconnected, 50 x 60 feet, and that it will purchase machinery and resume operations at the very earliest time possible in order to turn out threshing machines for the coming season.

Chas. A. Lefferts & Co., manufacturers of iron columns and structural castings, Brooklyn, N. Y., will extend their plant so as to cover the entire site, 100 x 100 feet, so as to make room for storing, cleaning and drilling columns, as well as to give additional space in the foundry for small work. The officers of the company are: Chas. A. Lefferts, president; J. A. Concaneu, vice president; John J. Jung, secretary and treasurer.

The Phœnix Iron Works, Meadville, Pa., have completed the building of a new foundry, 50 x 220 feet. The plant is equipped with modern appliances throughout.

The Union City Foundry Co., Union City, Pa., has been incorporated to manufacture hot water house heaters and to do a general foundry business. It is building a new foundry, 50 x 105 feet, with an L for pattern and machine work, and an engine and boiler room, 50 x 60 feet. It is in the market for considerable second-hand machinery, tools and appliances. The officers are: F. W. Burnham, president; E. Collopy, vice president; William Warden, treasurer; and W. N. Barrett, secretary and manager.

The Clinton Foundry Co., Clinton, Mass., has acquired more land adjoining its property and is planning to erect a new foundry next summer if the trade outlook warrants the expenditure.

GENERAL INDUSTRIAL NOTES.

The Charles Fawcett Mfg. Co., Ltd., Sackville, N. B., has been incorporated with a capital of $100,000. Incorporators are: Chas. Fawcett, Horace E. Fawcett, C. W. Fawcett, Fred W. Ryan, Walter Fowler and Kate J Fawcett.

The National Steel Foundry Co. has been merged with the National Steel & Wire Co. Both concerns have extensive works in Worcester, Mass.

The Putnam Foundry & Machine Co., Woonsocket, R. I., elected the following directors: William R. Barber, L. H. Fuller, Edward Mullen, J. C. Nichols, George E. Shaw, Arthur Stetson, W. J. Turner, Providence. The officers elected are: President, Edward Mullen; vice president, Arthur Stetson; secretary and treasurer, Frank A. Hopkins; general manager, W. R. Barber; assistant general manager, W. J. Turner.

The American Ship Windlass Co., Providence, R. I., has completed and put into operation a new brick foundry, 150 x 105 feet. The plant is lighted by electricity, equipped with a 10-ton electric crane and a 5-ton hand crane.

The cupola has a capacity of 10 tons per hour. The company has a wharf adjoining its plant which has 15 feet of water at low tide, thus giving it the advantage of water freights and enabling it to repair machinery of vessels of medium draft.

The Standard Foundry Co., Hartford, Conn., has been incorporated with a capital of $10,000. The officers of the company are: President, Allen C. Bill; secretary and treasurer, John W. Conway.

The Vaughn Foundry Co., Norwich, Conn., recently incorporated, succeeds A. H. Vaughn & Sons, whose business will be conducted on about the same lines as heretofore.

The Union City Foundry Co., Union City, Pa., has been incorporated with a capital of $20,000. The directors are: F. W. Burnam, Wm. Warden, W. N. Barnett, A. B. Seymour, J. R. Mulkie, W. L. Mitchell, E. Collopy, Union City. Treasurer, Wm. Warden, Union City.

The old Darragh foundry, Bridgewater, Pa., has been sold to the Crawford-Speer Foundry & Machine Co. for $15,000. The members of the firm are: Mrs. Emma L. Crawford and W. R. Crawford, Allegheny; John D. Speer, of Pittsburg; and Oliver C. Speer, of Emsworth.

The A. B. Warman Lackawanna Foundry Co., Scranton, Pa., has been incorporated with a capital of $150,000.

The Badger Machinery Co., of Milwaukee, Wis., has been incorporated with a capital of $25,000. It intends to manufacture engines and machinery. The officers are: Daniel M. Guibert, Charles A. Schuman and Louis Kurz.

The A. Kilpatrick Sons Foundry Co., St. Louis, Mo., capital $10,000, all paid, has been incorporated by: Alex. Kilpatrick, Alex. Kilpatrick Jr. and Alfred B. Kilpatrick.

The Homestead Valve Mfg. Co., Pittsburg, Pa., has started up an iron foundry in connection with its brass foundry, and by the use of converting furnaces is able to make a superior semi-steel valve.

The Strenuous Metallic Packing Co., of Pittsburg, Pa., has changed its name to the Little Arabooche Co. The capital stock will be increased from $150,000 to $250,000. The incorporators are: M. C. Reid, L. C. Andrews, Pittsburg; J. G. Gray, Wilmington.

The Pittsburg Machinery & Gas Engine Co., Pittsburg, Pa., has been incorporated with a capital of $10,000. The directors are: J. P. Koehler Sr., L. C. Koehler, Shaler township, Allegheny county, and M. M. Tygard, Pittsburg.

The Fisher Foundry & Machine Co., Pittsburg, Pa., is arranging to build a new plant in Connellsville for the manufacture of a newly-designed steam engine.

The Bingaman-Savage Brass Co., Pittsburg, Pa., has been incorporated with a capital of $20,000. The directors are: Charles A. Bingaman, N. F. Savage, Pittsburg; Cornelius N. Savage, California.

The Buffalo Steam Roller Co. has increased its capital stock from $125,000 to $200,000.

The Tompkins Bros. Co., Troy, N. Y., has been incorporated to manufacture machinery. Capital is $50,000. The incorporators and directors for the first year are: A. Tompkins, I. A. Tompkins and E. Tompkins, all of Troy, N. Y.

The W. H. Wilcox Co., Binghamton, N. Y., has been incorporated to manufacture machinery with a capital of $40,000. The directors are: W. H. Wilcox, F. C. Wilcox and H. J. Mitchell, Binghamton.

The Cohoes Foundry & Machine Co., Cohoes, N. Y., has elected the following officers: President, Mrs. A. E. Johnston; vice president, D. S. Johnston; treasurer, H. E. Johnston; secretary, William H. Shields.

The pattern making department of the Holly shops, at Lockport, N. Y., has been moved to the plant of the Snow Steam Pump Works in Buffalo. The machinists, numbering about 200, are the only employes of the Holly plant now working at Lockport. It is expected that they will move to Buffalo in about four months, after a large contract on which they are now employed is completed.

The Miller Gas Engine Co., Springfield, O., has shut down for an indefinite period, throwing 90 men out of employment.

The steel-casting plant built by J. S. Coxy, at Mt. Vernon, O., is to be sold at private sale by the receiver, James Israel, of Mount Vernon, O.

The Wehrle Stove Works, Newark, O., were opened Jan. 4 with a force of 60 molders. When they get the entire plant in operation they hope to employ 1,200 men.

The firm of Utz Bros., formerly of Hamilton, O., has started its new brass and bronze foundry in Middletown, O.

The Akron (O.) Foundry Co. has elected the following officers: President and treasurer, Frank Fieberger; vice president, F. Nolte; secretary, F. B. Theiss.

The Ober Mfg. Co., Chagrin Falls, O., has been incorporated with a capital of $40,000 to manufacture machinery, sad irons, handles, lumber, etc. The incorporators are: Martha M. Ober, Lena B. Woodburn, Addie R. Ober, Laura A. Matthews, A. M. Ober and M. W. Woodburn.

The William Tod Co., Youngstown, O., has put its employes on double turn on account of the large volume of contracts on hand.

The Toledo Car Wheel & Foundry Co. has elected the following directors: C. E. Milmine, L. S. Baumgardner, W. W. Bolles, A. Milmine. The officers are: President, C. E. Milmile; secretary, H. B. Milmine.

The Wilks Foundry Co., Toledo, O., has elected the following directors: M. J. Rigs, Charles H. Cummings, Dr. G. M. Kinsey, Harvey Crane, Will Brown, Thomas Davies and Charles T. Wilks. This company has enlarged its plant considerably during the past year.

The Cleveland Foundry Supply Co., Cleveland, O., has been organized with a capital of $5,000. Incorporators are: Walter Rutson, W. J. Patterson, Sam Livingston, Harry Reisch and D. A. Doolittle.

The Standard Sand & Foundry Supply Co., a co-partnership company, has reorganized and been incorporated under the laws of Ohio. The new name is the Standard Sand & Machine Co. The new firm assumes all of the responsibilities of the old company and expects to continue the business of furnishing sand and sand handling machinery. The company is located in Cleveland, O.

The International Mfg. Co., Columbus, O., has been incorporated with a capital of $3,750,000. The plant of the Hallwood Cash Register Co. will be taken over by the new corporation and its plant enlarged.

The Columbus Foundry & Machine Co., Columbus, O., has been incorporated with a capital of $10,000. The incorporators are: J. F. Angell, Eli Rowles, Grant Cusac, J. Embleton, M. Foy McDowell.

The Kramer Bros. Foundry Co., Dayton, O., has been incorporated with a capital stock of $100,000. The incorporators are: Bernard H. Kramer, George H. Kramer, Bernard H. Kramer Jr., Frank J. Kramer, Anna M. Kramer and Charles W. Eliff.

The Brownell Co., Dayton, O., has been incorporated with a capital stock of $950,000 to manufacture engines, boilers, saw mills, sheet iron work and general machinery. The incorporators are: Bradford Shinkle, S. E. Hilles, J. H. Gibson, G. V. Richards, G. Puchta, J. M. Crawford, C. A. Hinsch, C. H. M. Atkins.

The stockholders of the Seybold Foundry Co., Dayton, O., elected the following directors: Charles Seybold, Frederick Bradmiller, Joseph Burns, Charles Passe and J. Edward Sauer. The directors elected the following officers: President, Charles Seybold; secretary and treasurer, J. Edward Sauer; general manager, Joseph Burns.

A deal has been closed by which C. F. Heritage purchased the interest of Geo. Headley in the Wooley Foundry & Machine Co., of Anderson, Ind.

The Central Car & Foundry Co., Vincennes, Ind., has been incorporated with a capital stock of $25,000, to deal in car and foundry material for use in railway car construction. The directors are: Joseph Cavanaugh, H. E. Frazier, Otto Winkenhoffer, Charles G. Mueller and T. J. Moll.

The Intermittent Horse Power Co., Dixon, Ill., has been incorporated with a capital of $75,000. It intends to manufacture machinery. The incorporators are: D. H. Law Sr., A. M. Smith, G. M. Weed.

The Peoria Foundry Co., Peoria, Ill., has increased its capital stock from $10,000 to $20,000.

The Hopke Foundry Co., Rockford, Ill., has completed its new foundry, which replaces the one recently destroyed by fire. The building is 70 x 100 feet and new equipment has been installed throughout.

The manufacturing plant formerly owned by Charles H. Presbrey, Sterling, Ill., which was known as the Novelty Works, is to be purchased by its present manager, William J. Burleigh, and Charles G. Johnson, who is at the head of the foundry.

The American Foundry Co., Bloomington, Ill., presented each one of its employes with a two-dozen case of assorted canned goods as a Christmas gift. There are over fifty employes and it kept the delivery wagon busy about all day delivering the goods.

The Griffin Wheel Co., Chicago, has increased its capital stock from $3,000,000 to $4,000,000. The plant of the company, which manufactures car wheels, has recently been enlarged and is in operation night and day.

The Crane Co., of Chicago, has followed its regular custom of giving its employes a Christmas present from the earnings of the company.

This year the amount distributed was $250,000. The company gave not only those who are now in its employ, but those who had been laid off during the year, the proportion which each received being dependent upon the portion of the year the person had been employed by the company.

Fitzhugh Luther & Co., Chicago, Ill., have purchased the United States Locomotive Works at Hammond from Gostlan & Meyn, who purchased them at receiver's sale recently. The new owners expect to operate the plant.

The Walsh Brake Shoe & Foundry Co., Chicago, has been incorporated with a capital of $100,000. The incorporators are: Julius Moses, Hamilton Moses, F. J. Noonan.

The Webster Mfg. Co., Chicago, just incorporated. It is not a new company, having been first established in 1876, incorporated in 1882 and re-incorporated recently. Capital stock is $350,000.

The Union Iron Foundry, Seattle, Wash., began operating the new foundry on Jan. 1. The building is 80 x 120 feet and equipped throughout with modern machinery.

The Washington Pipe & Foundry Co., Tacoma, Wash., has purchased the plant of the Deming-Berry Pulley Co. and will enlarge the works of the former company and install considerable new machinery.

The Headford Bros. & Hitchkins Foundry Co. has changed its headquarters from Dubuque to Waterloo, Iowa. The officers are: President, E. H. Headford; vice president, F. O. Hitchkins; secretary and treasurer, W. T. Headford.

The El Paso Foundry Co., El Paso, Texas, has amended its charter by increasing its capital stock from $100,000 to $200,000.

As a New Year's gift to his sons, F. O. and J. B. Green, Samuel Green, of Des Moines, Ia., turned over his entire business interest to them. Mr. Green has retired from business at the age of 71. The firm has been known as S. Green & Sons, manufacturers of furnaces and stove repairs. Under the new arrangement there will be two companies, F. O. Green's department being known as the Green Furnace & Foundry Co., while J. B. Green's business will be known as the Des Moines Stove Repair Co.

The Southwestern Foundry Co., Dallas, Texas, has been incorporated with a capital of $3,000, to do general foundry business.

The St. Louis Locomotive & Machine Works elected the following directors and officers: M. M. Stephens, George W. Allen, Charles A. Huff, Henry D. Cleveland, T. M. Gallagher, W. S. Forman and John S. Ray. The officers are: M. M. Stephens, president; George W. Allen, vice president and treasurer; Charles H. Huff, second vice president: H. D. Cleveland, secretary; John P. Ray, superintendent.

The Tower Grove Foundry Co., St. Louis, Mo., has been incorporated with a capital stock of $6,000, to do a general foundry business. The incorporators are: Aloysius Krebs, Fred W. Priess, Fred G. Schulz and Henry F. Welsch.

The business of Findlater & Copeland, San Angelo, Texas, has been incorporated as the San Angelo Mfg. Co., with a capital of $25,000. It expects to enlarge the capacity of the plant and erect a new foundry. The incorporators are: John Findlater Jr., J. R. Copeland, George Richardson and E. R. Jackson.

The plant of the Bogenshutz Stove & Range Co., Covington, Ky., has been purchased by John C. Droege.

About the middle of December a boiler explosion occurred in the plant of the Heunafed Stove & Range Foundry, at Augusta, Ky. Fortunately, the explosion occurred at meal time, when most of the men were away from the works, and hence no one was killed; however, a number were injured. The explosion wrecked the plant badly, causing damages to the extent of $7,500 to $10,000.

The Cosgrove Foundry & Machine Works, Jacksonville, Fla., have been sold to J. S. Reese for $15,000.

The Golden Foundry & Machine Co., Columbus, Ga., entertained their employes and friends on Jan. 2 with their annual oyster roast. From 7:30 to 11:30 p. m. the plant was crowded with people coming and going and eating their fill of oysters, which were served in several styles.

The Gresham Planing Mill Co., Griffin, Ga., has installed a foundry for the production of castings for local use.

The George Foundry & Machine Works, Rome, Ga., has been sold to C. Turhune and Jerome S. Brown. The price paid for the plant was $20,000.

The Anniston plant of the Southern Car & Foundry Co., Anniston, Ala., has been purchased by Capt. Jas. M. Elliott, of Gadsden, Ala.

The Enterprise Foundry Co., Bristol, Tenn., has passed out of the hands of a receiver back into the hands of the George Bros., the original

owners. This plant was moved from Knoxville to Bristol about two years ago, and went into a receiver's hands about one year ago.

The United States Cast Iron Pipe & Foundry Co.'s plant at Bessemer, Ala., which was closed Dec. 23, resumed operations Jan. 4. Extensive repairs have been made.

The foundry plant of the Bates Metal Co., Birmingham, Ala., has been sold to the Ajax Metal Co., Philadelphia.

The water board of St. Paul, Minn., has awarded to the Dimmick Pipe Foundry Co., Birmingham, Ala., the contract for the year's supply of cast iron pipe at $23.35 a ton. Last year the board paid $32.30 a ton for cast iron pipe.

The Beloit Iron Works, Beloit, Wis., recently were awarded a large contract for equipment for a British paper mill owned by Chicago interests and known as the Thames Paper Mills, located near London.

The Badger Machinery Co., Milwaukee, Wis., has been incorporated with a capital of $25,000. It expects to manufacture engines and machinery.

The Stowell Mfg. & Foundry Co., South Milwaukee, Wis., gave a dinner to its officers and salesmen on Jan. 5.

The Milwaukee Steel Foundry Co., Milwaukee, Wis., recently incorporated, has leased the Rundle & Spence foundry at South Water and Virginia streets and equipped it with the latest improved machinery for making a specialty of small steel castings from ¼ pound up to 500 pounds. It is installing the converter process.

The new foundry of the United Steam Pump Co., Battle Creek, Mich., poured its first heat Jan. 1. It is stated that everything went off very satisfactorily.

The Riverside Foundry Co., Kalamazoo, Mich., has elected the following directors: M. J. Bigelow, W. N. Pomeroy, Homer Manvel, A. M. Dailey, M. F. Richardson. The following officers were chosen: President, M. J. Bigelow; vice president, W. N. Pomeroy; treasurer, A. M. Dailey; secretary and manager, M. F. Richardson.

The Northwestern Foundry & Supply Co., Detroit, Mich., has elected the following officers: President and general manager, H. D. Keller; vice president, J. F. Schaening; secretary and treasurer, T. E. Robinson.

At the annual meeting of the stockholders of the American Bell & Foundry Co., Detroit, Mich., the following directors were elected: Frank S. Harmon, Charles S. Filkins, William Phillips, Robert C. Yerkes, Frank S. Neal, James Shaw and Lawrence W. Simmons. Frank S. Harmon was re-elected president and general manager for the ensuing term. This company began the manufacture of bells in 1895, but later extended its operations, doing a general machine shop and foundry business.

The first casting of malleable iron at the new works of the Wilmington Malleable Iron Co., South Wilmington, Del., was made Jan. 7. The casting proved to be very satisfactory.

The Jackson Architectural Iron Works has sold its foundry building, machinery and land at Cranford, N. J., for about $60,000.

On Feb. 4 the property of the Eddystone Foundry & Machine Co., formerly the Gruson Iron Works, of Eddystone, Pa., is to be sold at public sale.

The Sheriffs Mfg. Co., of Milwaukee, Wis., is celebrating the 50th aniversary of its existence, the company having been organized in 1854.

The Lunkenheimer Co., Cincinnati, reports that, owing to the great increase in the demand for its specialties, it has again greatly increased the capacity of its plant.

The Vulcan Works, Chester, Pa., have secured a contract for making furnace fittings, flasks and other cast and wrought iron work for the Baldt Steel Co., New Castle, Del. The contract involves about 500 tons of material.

The Alliance plant of the American Steel Foundries has been closed down for an indefinite period. Up to December the plant employed about 800 men, but at the time of closing last week there were only about 300 employed.

The Fay & Bowen Engine Co., Geneva, N. Y., has been incorporated with a capital of $40,000. The directors are: W. L. Fay, E. S. Bowen and Henry Brewer, of Geneva

It is reported in New York that the Pennsylvania Railroad Co. will reject all bids submitted Dec. 15 for the construction of its tunnel under the East and North rivers. The bids are said not to be satisfactory to the engineers of the company and it is thought that the company will either do the work itself or call for new bids.

The American Car & Foundry Co. has asked the men in the Terre Haute shops to accept a reduction of about 20 percent in wages to enable the company to take a big contract with the Big Four railroad. The works at present are almost idle.

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